# The American Journal of Surgery

*Editor*: THURSTON SCOTT WELTON, M.D., F.A.C.S., NEW YORK

*Editor, Department of Radiology*: JAMES T. CASE, M.D., F.A.C.S., CHICAGO

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NEW SERIES, VOLUME XIV

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**The American Journal of Surgery is truly independent and enters into no "entangling alliances." It publishes many papers read before the leading surgical societies of the Country, but it is *not* "the official organ" of any organization. Every manuscript is selected by the editors, as worthy of publication—nothing is published merely because "it was read at the meeting."**

## EDITORIALS

THIS number of THE AMERICAN JOURNAL OF SURGERY is issued in honor of Dr. Rudolph Matas of New Orleans. The entire contents have been written especially for the Matas Birthday Volume. Single copies will be available only with annual subscriptions. The volume will be republished in book form in a limited edition of 1000 copies. The first 400 will be numbered, and signed by Dr. Matas, and will be available through the Committee only. The balance of the edition will be offered for sale by the publishers. The regular departments of THE AMERICAN JOURNAL OF SURGERY: Biographical Brevities, Bookshelf Browsing, Book Reviews and the installments of Cutting's "Principles of Preoperative and Postoperative Treatment" will be resumed beginning with the November issue in which the double column also will be restored.

T. S. W.

*This volume is affectionately dedicated to*
PROFESSOR RUDOLPH MATAS
*our esteemed teacher, colleague*
*and revered friend*

THE PLAN TO PUBLISH A VOLUME OF SURGICAL ESSAYS IN HONOR OF PROFESSOR RUDOLPH MATAS ORIGINATED AMONG A GROUP OF HIS FRIENDS AND FORMER PUPILS. WE TAKE THIS OCCASION TO THANK THE CONTRIBUTORS FOR THEIR CO-OPERATION. WE WISH PARTICULARLY TO THANK THE FRIENDS AND PATIENTS OF DR. MATAS FOR THEIR SUPPORT WHICH HAS MADE THE PUBLICATION OF THIS VOLUME POSSIBLE. WE ALSO WISH TO TAKE THIS OCCASION TO THANK THE PUBLISHER FOR HIS UNFAILING GENEROSITY WHICH HELPED TO MAKE THE PUBLICATION A SUCCESS.

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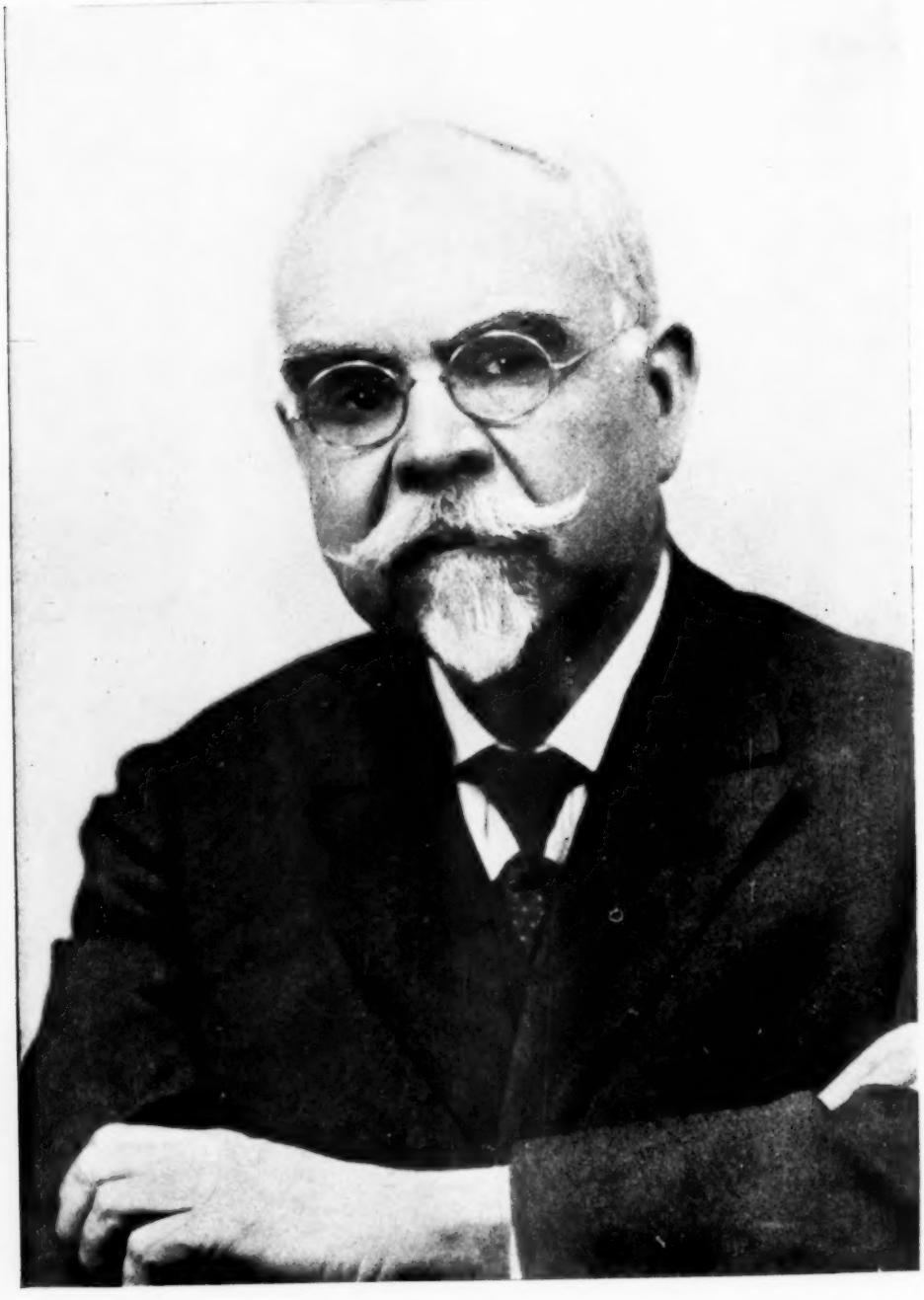
*Frontispiece, Matas Birthday Volume, The American Journal of Surgery, October, 1931*



Rudolph Matas

# AN APPRECIATION OF PROFESSOR RUDOLPH MATAS

THIS volume is affectionately dedicated to Dr. Rudolph Matas—our teacher, colleague and friend.

This anniversary which we are celebrating represents the close of five decades of his professional life, as well as the attainment of the Biblical three score and ten. This anniversary is a great epoch in his life as well as in the history of the medical profession of our country.

It is proper that this volume should be dedicated to him who so fittingly represents, by his heredity and accomplishments, the great state in which we live. Louisiana boasts that it has shared the fortunes of four nations—France, Spain, United States of America, the Confederate States, and again proudly our state became a member of the Union. Our beloved friend was born in Louisiana of Catalonian parents just prior to the great Civil War, was educated in Spain and in France, and then he returned to his native Louisiana to grow in strength, and add lustre to our state and nation.

As early as 1879 Dr. Chaille recognized the potential abilities of the young medical student and selected him as secretary of the Commission studying sanitary conditions in Cuba. This association was the beginning of a most beautiful and devoted friendship which lasted during Dr. Chaille's lifetime. It may be said that Dr. Chaille influenced Dr. Matas more profoundly than anyone else. How fortunate this association was can only be guessed.

When one thinks of Dr. Chaille (the methodic precision with which his daily routine was followed, his remarkable analytic mind, and the fearlessness with which he expressed his convictions) it is easy to see how his influence was so remarkable as a guiding factor in the life of his younger colleague, Rudolph Matas.

Soon after graduation, Dr. Matas became identified with the Department of Anatomy of Tulane University. His untiring efforts and his brilliant accomplishments made him the logical successor to Dr. A. B. Miles whose untimely death created a vacancy in the Department of Surgery. The selection of a successor for Dr. Miles created much discussion and controversy because the faculty sought an outsider. Dr. Andrew W. Smyth in 1893 said:

> It is nothing short of an outrage that the faculty of Tulane university should entertain the idea of going to Baltimore to fill the chair recently made vacant by the death of Dr. Miles. Dr. Matas has genuine ability, which, in my judgment, is superior in many respects to genius itself. He is beyond question the greatest surgeon New Orleans has ever possessed. There is nothing that he teaches that he does not exhaust. I feel certain that the future will certainly corroborate the opinion which I now express regarding Dr. Matas, and any honor bestowed upon him will be justified by history. I am in earnest when I say that Matas is a greater surgeon than Stone, Miles or Smythe have ever been, and he is profitting by experience, reading and writing all the time. Whatever position, reputation or standing he has thus far acquired in the profession, is the result of his own intrinsic merit and the application born of intelligence and superior judgment. Besides his knowledge of his profession, he has versatility as well, being scholarly, and a clear and fluent writer, on any subject. [Smythe.]

According to Miss Jane Grey Rogers: "Teachers, students, citizens all united in one grand chorus of support, and again harmonized into one tremendous Amen when the final decision of the faculty became public property."

It is a source of great regret that this note of appreciation could not have been written by Miss Rogers whose intimate contact with Dr. Matas for many years made her his natural biographer. In token of this desire, to make her take part in this anniversary testimonial of esteem, it is fitting that we take something from her writings.

In an editorial in the *New Orleans Medical and Surgical Journal*, December 1924, Miss Rogers, discussing the election of Dr. Matas to the Professorship of Surgery, said:

So it came about that the youthful acolyte passed from his novitiate into the full heritage of knighthood and received the chair of surgery as a token of his unblemished chivalry and unswerving devotion to the vision of High Calling. There may he long remain the great high priest of surgical principles and medical ethics, in whose consecrated hands the scalpel remains an untarnished excalibur, potent in the exercise of good, and equally powerful in the destruction of evil.

In this memorable editorial of hers, Miss Rogers said: "Were it permitted 'The Soul of the Surgeon' to assume fleshly form, there are not a few among us who strongly suspect that the incarnation would wear the familiar features and walk the accustomed ways of that 'good physician,' Rudolph Matas, with whose inspiring presence it has pleased God to bless our generation."

Let these expressions symbolize a bond in immortality of this gentle lady, who has passed on, with our Chief "whose glorious name, even while he still lives, flashes in the constellation of immortality." (Jane Grey Rogers.)

The pean of praise, begun by Dr. Andrew W. Smyth and his contemporaries, has continued through the years gaining in volume and in harmony until today great symphonies have been written by Cushing, Porter, Frederick L. Hoffman and others who have been privileged to meet him on occasions. Those who know Matas best and love him most are anxious that these evidences of appreciation should be more generally known, therefore, the tribute paid by Cushing at the time of the presentation of the Bigelow Medal is liberally abstracted:

Rudolph Matas: Through the generosity of a man, whose recent death we greatly lament, it has been made possible for the Boston Surgical Society to confer from time to time, at their discretion, a medal in memory of his distinguished father, a medal upon those who likewise have attained particular eminence as surgeons . . .

This society has already bestowed the award upon a surgeon of the Middle West, the originator and main-spring of a famous clinic; then upon another, justly regarded as the doyen of American Surgery, a man of imperishable youth, whose sesquicentennial, it is rumored, is being held in his native Quaker city. It now has again unhesitatingly, unanimously,

and fittingly voted the award to you who represent still another section of our vast country . . .

The surgery of the South flows by your door as do the Waters of De Soto's mighty river by the levees of the romantic city which claims you. But you, sir, on your record, would have been our choice, residing in any land. Chance only has placed us in a common nation. The Louisiana purchase; the migration to Bonnet Carre of a Spanish physician, your father; the preservation of the Union. These three happenings conspired to make you a great leader in American surgery, instead of the great leader that you otherwise might have been in the surgery of your father's native Spain where you had your boyhood education; or in what might have been the Southern Confederacy, or indeed in what might have remained Colonial France.

In your professional life you have exemplified what Guy de Chauliac said the surgeon should be; "Bold when sure, Cautious in danger; Kind to the sick, Considerate of your fellow workers; Uninfluenced by gain . . . But you have been more than this. You have been a faithful and inspiring teacher in your Alma Mater to a host of students this past forty-six years. You have made notable additions to knowledge. Yet your genersoity has led you habitually to magnify the importance of work done by others; your native modesty to minimize the importance of your own. Your contributions have been characterized not only by a Castillian brilliance of conception, but by a Gallic gift in exposition which we inarticulate people largely of Puritan ancestry can but envy and admire.

At this time Dr. Porter paid Dr. Matas the following tribute: "His genius, like a bright jewel with many facets, has illuminated many of the dark places in surgery. To know him is to realize the heights of his idealism and to fall at once under the spell of his lovable personality."

Dr. Frederick L. Hoffman, one of the world's greatest statisticians and a loyal friend of Dr. Matas, expressed his appreciation in the following poem:

Son of the Latin Southland
  Son of a sunkissed soil,
Born to the purple but man of choice
  To a life of arduous toil.
Known to all as a surgeon
  Master of exquisite skill,
Saving the lives of the dying,
  Comforting, aiding the ill.

Friend to all who are struggling,
  Kind to the lowly and poor,
Generous host to those who pass
  Through his always open door;
Versed in all arts and in science,
  Gifted with grace and with tact,
In peace and in war in the forefront
  Never afraid to act.

Teacher of countless students,
  Medicine's proudest boast,
Leader in every movement
  In matters that count the most.
Beloved by all who know him,
  Rich or of slender means,
The pride and joy of the city
  Of beautiful New Orleans.

May he live long and be happy
  Wearing the laurel he's won
Sorrow will fall on the city
  When in time his labors are done.
But enshrined in the hearts of the people
  Will be the name of the surgeon who was,
Live on forever and ever,
  The deathless fame of Matas.

We marvel at the developments of surgery since Pasteur and Lister yet we only know it from history and tradition. The great leader whom we honor at this time had grown into manhood before the principles of Lister had been generally accepted, in fact, one of his intimate friends and contemporaries, the late Dr. Frederick W. Parham, that mild mannered, simple, honest, noble gentleman, was the first to introduce sterilization by steam into Charity Hospital at New Orleans.

Rebellion was in the air soon after the birth of Dr. Matas; rebellion not only within the Union, but in medicine. This rebellion was soon to break out. Empiricism was to be set aside and science to replace it. No single soldier in the army of progress has fought more valiantly than Matas to set aside

tradition for scientific principles. Early in his career he substituted the scalpel for the amputating knife, the Gigli saw for the old butcher saw, the tourniquet and Esmarch bandage were utilized by him in an effort to obtain an almost bloodless field. No effort was too great for him to use to prevent loss of blood. Fine anatomic dissections replaced the sleight-of-hand performance of the older surgeons. The introduction of local anesthesia, in which he was a pioneer, enabled him to reduce the painful effects of mutilating operations. Finally his triumphant efforts in the field of vascular surgery crowned him with glory and made him properly one of the generals in the victorious army of the rebellion.

No one has ever been better fitted by natural physical powers to stand the great struggle than he. One of his proudest possessions, according to his own statements, is his inheritance of a strong constitution. On the occasion of the presentation of a token by his New Orleans friends, after he had received the Bigelow Medal, Dr. Matas said:

> To my parents, I owe a clean and robust inheritance, an honesty of purpose, a sense of duty and perhaps, from my father, who was also a Doctor of Medicine, the congenital inclinations and the elementary foundation for a medical career. For these, I owe them a debt far more precious than all the fortunes and all the titles that they could have bequeathed me.

In his greatness he is still humble. When a great honor was conferred upon him he shared with his teachers, pupils, and the profession generally his success. The following abstract evidences the truth of this statement:

> To my profession, to Medicine, I owe everything that has helped to make me useful and thoroughly contented with my lot . . .
>
> I fancy that I can see the shades of my venerated teachers Chaille, Richardson, Bemiss, Logan, Elliott, Sr., Joseph Jones, Souchon and Miles, the stalwart group who composed the Faculty of my student days; they who ushered me into the medical world—now all vanished from this earthly sphere, but living still by their example and their teachings, and by their indelible impress on the Roll of Honor of medical Louisiana . . .

And now the vision changes and I see another picture. I see marshalled a great army passing in review before me. It is the army of the Alumni of the medical school who have been graduated in Medicine during the years of my incumbency. This is the host of health and healing, nearly 3,500 strong, taught, and drilled in the training camp of Tulane; intelligent, educated men, flaming with youth and ambition, to carry the seed of knowledge and service to all quarters of the continent and far beyond the seas, under the banner of Tulane. To all these, who in the procession of the years, have sat in successive classes on the benches before me, and to the many who have served me loyally and diligently as interns, in my service at the Charity and Touro I owe an immeasurable debt. Not only for their material collaboration in accomplishing the tasks in which I have been engaged, but to the whole student body for the inspiration, the stimulus, the compelling influence that their enthusiasm and inquisitive youth have had upon me in sharpening the edge of my own intelligence, that I might be fit to guide them, in the ever-changing, ever-advancing knowledge of the craft, and to give firmness to my hand that I might hold the torch of Hippocratic tradition and conduct steadily before them.

In an effort to express a word picture of our great and distinguished teacher we must turn back the pages of history to find de Chauliac's statements of the "Qualifications of a Surgeon":

Let the surgeon be well educated, skilful, ready and courteous. Let him be bold in those things that are safe, fearful in those that are dangerous; avoiding all evil methods and practices. Let him be tender with the sick, honourable to men of his profession, wise in his predictions, chaste, sober, pitiful, merciful; not covetous or extortionate; but rather let him take his wages in moderation, according to his work, and the wealth of his patient, and the issue of the disease, and his own worth.

Let us for a moment pause and let our own beloved teacher give his own conception of the qualities which the surgical mind should possess:

The surgical mind manifests a special fitness to serve the functions of surgery in the artistry with which the Surgeon applies the scientific principles of his craft, in the clarity of his vision, and the breadth of his concepts, in the wisdom of his judgment, in his initiative, in his daring and resourcefulness; in the courage of his enterprises, in his high sense of duty, and his sensitiveness to his professional responsibilities; in his sleepless vigilance

for the safety of his patients, and in the adjustment of his physical qualities to his mental processes . . .

Salient among the qualities of the surgical mind is that highly prized faculty that is known as surgical judgment.

These qualifications which Dr. Matas has outlined in words have been indelibly impressed on his associates by his deeds. The intangible expressions which he uses, Soul of the Surgeon, Surgical Mind, and Surgical Conscience are given visible human form and have been electrified into action by his own consecration to the idealisms which he practices.

It is almost a hopeless task to convey an idea of his education because his fund of information is so much greater than that of his associates that we can only guess its limitations. We only know that no one of his associates has ever been able to find a subject whether it be medicine, in any of its branches, art, music or the sciences, about which he is uninformed.

Many stories could be introduced to illustrate this point. A few will serve the occasion.

A distinguished internist was once asked whom he considered the one Doctor who alone could be depended upon for diagnosis and suggestions for treatment of medical cases. This internist unhesitatingly said—Dr. Matas.

Many great American surgeons have unequivocally stated that Dr. Matas is the best informed surgeon in America. One of his former interns on an occasion thought he had found something which the Chief had not read. Having read the article in a Canadian medical journal this intern asked Dr. Matas, the following day, what he thought of the problems discussed in this article, to which Dr. Matas replied, "recently a very interesting article appeared in a proprietary Canadian journal covering many valuable points about the problem you are interested in." At once the intern realized that even the proprietary journals had not escaped Dr. Matas's uncanny ability.

Lafcadio Hearn, who was a great friend of Dr. Matas, paid tribute to his versatility in a letter to Dr. George M. Gould of Philadelphia. He wrote:

My friend is very young, but already somewhat eminent for some years at our University, and will ultimately, I am sure, turn out a great name in American medicine. But he is a Spaniard, Rudolfo Matas . . .

I first felt really quite curious about him after having visited him to obtain some material for a fantastic anatomical dream-sketch and asked where I could find good information regarding the lives and legends of the great Arabian physicians. When he ran off a long string of names, giving the specialties of each man, and criticising his work, I was considerably surprised; and even felt a little skeptical, until I got hold of Leclerc and Sprengel and found the facts there as given me by word of mouth.

This versatility includes a linguistic range that made him a marvel to his interns. As he would go from bed to bed in our great institutions in New Orleans, he would address his patients in French, Spanish and in Italian. The most lowly were made to feel just as much at home with him as the most highly educated. Each patient was made to feel grateful because of the ministrations of our distinguished friend, whether those ministrations were to the physical or mental needs of the patient.

His mind is remarkably receptive and retentive. The quality of visualizing his knowledge of anatomy for utilization in surgery has inspired his associates, and has enabled him to extricate himself and his patients from difficulties that would have been unsurmountable by one less well informed.

Dr. Matas may be truly called an artist in surgery as contradistinguished from the artisan. The artisan or operator executes manual acts often dictated by his medical confrere. Dr. Matas, the artist, has made the execution of his work symbolic of his appreciation of the tasks which have confronted him. His efforts have evidenced his love of the opportunity of relieving the suffering and of directing others in paths that would bring aid to untold thousands who will be totally unconscious of the guiding influence in their recovery.

By recording his impressions of the tremendous amount of clinical material which he has seen and correlating these with a knowledge of the literature, he has added to the storehouse of human knowledge. This combination of knowledge and observation has made his diagnostic acumen the wonder of his

associates. His indefatigable energy can best be understood if interpreted in the words of the late Arpad G. Gerster: "Love of one's chosen work has the magnetic power of turning Adam's curse into a blessing."

His work as a surgeon has been revealed in his writings. Particularly do we find a mirror of his life and work in his appreciation of Halsted. Dr. Matas has constantly inveighed against "Prize Ring" tactics when applied to the operating room. He has rather practiced and pleaded for the conscientious application of knowledge for the saving of life and limb.

It is futile to try to describe his attitude when he has given it to us in such a clear way in his appreciation of Halsted. He does not reckon as brilliant

> . . . the surgeon who utilizes his opportunities to dazzle the public with the prodigies of his skill, who listens for the plaudits of the multitude more intently than he does to the murmured approval of his conscence and who burns his incense to the gods of the gallery. I do not reckon speed as brilliancy when displayed chiefly, if not solely, for spectacular effect; when it is exhibited at the expense of security and when appraised as skill it is rated above caution and judgment at the hazard of the patient's highest interests. According to my understanding brilliancy in surgery lies more in the results of the surgeon's intervention than in the immediate act. To my mind he is the most brilliant surgeon, who, in equality of circumstances, saves or prolongs the greatest number of lives and who restores his patients to health in the shortest number of days. [This is the] sort of brilliancy for which every conscientious surgeon who places his patient's welfare and the good repute of his profession above the vanity of his own flesh, should strive. Admirable and necessary as is the cunning of the hand, its obedience to command is not all. Something more is required. The surgeon needs to cultivate the subtle touch, the sentient finger and obedient hand. He needs the broad vision that is his only through the light of science, the cultivated imagination, the catholicity of artistic taste and human sentiment, that give to his manual accomplishments the attributes and qualities that glorify the hand in the higher arts. To do all this, and to be all this, the master surgeon must be a man of mind, a man of thought, and a man who knows his province—the human body—as a whole and not only in one of its parts.
>
> The human body is the only model that the surgeon can follow if he is to apply his craft with certainty and safety. Anatomy in its applications to surgery is as necessary to the surgeon as a chart to the navigator, and

the surgeon can no more be trusted to find his way in a tangle of vital organs, blood vessels, muscles and nerves, which make up the flesh, and conduct his operations to a successful issue, than a pilot could be trusted to guide a great ship, loaded with human freight, to a safe berth in a dangerous harbor, without an intimate knowledge of its tortuous channels and its treacherous shoals.

Today when we find attempts being made to shorten the training of the medical student in anatomy there is reason for reflection lest we find the future surgeon less well prepared than his predecessor.

Dr. Matas, even though success has crowned his efforts, has never allowed the bright lights to dim his vision. Each success has simply spurred him on to renewed efforts so that he might continue to record his impressions and rise to greater heights. Like all great torch bearers of knowledge he has linked by his efforts the past with the present that the future may be more glorious because of his having lived.

His life has been the embodiment of the principles enunciated by Tennyson in his Flower in the Crannied Wall:

> Flower in the crannied wall
> I pluck you out of the crannies;
> Hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

Emerson said that "Character is higher than intellect." The consecration of our friend to the cause of humanity, his fight on charlatanism, fee splitting and all such degrading practices mark him as one who has fought to keep the banner of surgery on the heights. From the "Soul of the Surgeon" I quote:

Charlatanism, like all other forms of parasitism, has always existed. The outward forms of the parasite—his morphology—have changed with different ages, climes, and people, and, in this, it has simply followed the laws of adaptation to environment that characterize all other forms of parasitic life. The externals change, but the biologic instincts, the symbiotic habits, and the vampirism of the parasite remain the same . . .

Let us not, then, confuse the parasite with the host. Let us not mistake the false from the genuine. The imposter in surgery is a soulless individual and, as such he has no place in a discussion on the Soul of the Surgeon—except to repudiate him as counterfeit or false coin.

Again Dr. Matas says with reference to this group:

Unfortunately, Surgery, as all other professions, the law, and the ministry, has its due proportion of moral defectives, who, are born conscienceless, who may be intelligent, but soulless; who gain entrance into the fold, as wolves disguised in lamb's clothes. These are men who only dream of their sordid ambitions, either for lucre or to satisfy their craving for notoriety as great operators, and whose sleep is never disturbed by reproachful visions of funeral processions; whose failures only worry them because of the effect they may have upon their reputation, their bank account, or their statistics. These men, not unlike the egotistic conquerors of History, are moral monstrosities, fit only to be exhibited in pathological museums. They have no place in the hierarchy of Surgery and are only mentioned to be condemned and repudiated as the nauseous excreta of a healthy body.

Can any one who has been a pupil of Dr. Matas fail to have learned that the life entrusted to him is a sacred trust, that his responsibility is greater than can be estimated? Can he fail to appreciate that the life entrusted to him is something that cannot be recreated by the hand of man, and that through ignorance or neglect an irreparable damage may be done?

In the wards of his beloved institutions, Charity Hospital and Touro Infirmary, some of you well remember the opportunity that was yours of watching with him by the bedside for hours at night. Can you ever forget the rapidly fired series of orders for first one thing and then another as aids for the suffering and apparently dying individual? Can you ever forget the inspiration and instructions? Can you ever forget that it was under such conditions as these that many of us learned to appreciate the responsibilities which the surgeon shoulders? Of this responsibility Dr. Matas has spoken and from his work I quote the following:

It is he, the commander-in-chief, he, alone, who is responsible for the safe guarding of the life that is entrusted to his care. All the others like the officers and crew of a ship are merely responsible to him, as the Captain, for the faithful execution of his orders. The Surgeon may rest his trust and confidence in the expertness and efficiency of his collaborators and

subordinates, but the chief responsibility must always rest with him, and being his, must be exercised with authority, not only during the operation, but also before, perhaps long before and also after, perhaps long after, the operation has been performed . . .

If it has its tragic hours, its hours of bitterness and sorrow, it has also its superb and glorious hours, and the greatest joys. For what joy can be sweeter, or can compare with that of conquering disease, to triumph over Nature, and to be "even stronger than Death."

Appreciation of responsibilities has constantly characterized his life and his work and his devotion to duty has inspired us to emulate his example. Others may draw inspiration from the nobility of his words and deeds. If we be true to him we cannot fail to realize that the opportunity which was ours was the greatest privilege of our lives.

Dr. Matas has constantly maintained that clinical experience is of supreme importance for the development of sympathy, tenderness and charity for he says:

In the clinic you are brought face to face with a conscious human, whereas in the laboratory, the student has learned with the microscope how to distinguish between different strains of virulent and specific microorganisms,—the staphylo—and streptococci, the colon bacillus, the tubercle bacillus, the gonococcus, the treponema of syphilis and other innumerable germs and specific tissue cells, such as the cancer cell,—but when he comes to the clinic or the ward, he will be lost and utterly incompetent to recognize or distinguish between the diseases caused by these germs, when he sees them at the bedside, though they may be clearly and unmistakably stamped upon the countenance or the body of the patients. It is in his abiltiy to read the physiognomy of disease, to classify diseases, to recognize and identify morbid processes in their multiple disguises and protean phases; and, again, in appraising their effects on the human organism, as these are modified by the physical and psychical reactions that are peculiar to each and every individual,—that of the art of the Clinician, whether Physician or Surgeon, differs radically from the export in the laboratory.

Of the Tactus Eruditus, about which he has written so much—no one has ever possessed, we believe, this power to a higher degree—he says:

The cultivation of the sense of touch has always been recognized as one of the characteristics of the surgeon.

The educated sense of touch of the experienced surgeon asserts its supremacy as a guide to the hand and to the mind, in its most difficult diagnostic and operative enterprises. Infinitely more valuable to the Sur-

geon, when in action, than the *x*-rays, since it allows the surgeon to discriminate between the normal and the abnormal and to operate in the deepest, darkest, and most dangerous cavities of the body, with a certainty and security that the most penetrating Roentgen light will fail to illuminate.

He has been truly a sunbeam in the dungeon to the patient and the family wrapped in the darkness of despair. If one may judge from the many expressions that have come from grateful patients he has gained through his efforts for them that spark of eternity or immortality which the human mind is capable of—gratitude, a gratitude which like the ripple produced by a pebble will increase as men gain a better knowledge of this great soul.

He is a true example of the individual who can still record impressions by continual work after he has been acclaimed by the whole world. If no other opportunity was ours as students of Tulane University than the inheritance that he was the great leader and inspiring teacher for more than thirty years, the privilege would be great. This teacher I am grateful to say lives for us to gaze upon. He stands as an embodiment of the truths of the profession which have been handed down to us through the ages.

When the influence of many of us will be scattered as grains of sand by the wind, Dr. Matas's influence will be as a beacon light across the storm-tossed sea in the life of many men. The rays of this light will continue to carry the message of devotion to duty, love of mankind, mercy to the needy and sick, and humility.

We marvel at him because he is possessed with Hippocratic powers of observation, the boldness of McDowell, the courage of Pasteur, the anatomic knowledge of Hunter and Da Vinci, and the cultural development of Weir Mitchell.

We say that he is a citizen of New Orleans. He is a rare mixture of the Old World and the New. He is a citizen of the World. He is a towering figure in the world of medicine and of men. He has proved himself to be a chivalrous knight and at once an humble worker, a literateur, a dreamer, an original thinker and a thorough master of the art of surgery. His ways are modest, his motives pure.

# RUDOLPH MATAS*

Born in Bonnet Carre, near New Orleans, La. September 12, 1860. Son of Dr. N. H. Matas and Teresa Jorda, both natives of Province of Gerona, Spain.

Primary education: Barcelona, Spain; Paris, France; Brownsville, Texas; Soule's College, New Orleans; graduate of Literary Institute of St. John, Matamoros, Mexico, 1876; M.D. Tulane University, 1880; LL.D. (Hon.) Washington University, St. Louis, 1915; SC.D. (Hon.) University of Pennsylvania, 1925; LL.D. (Hon.) University of Alabama, 1926; SC.D. (Hon.) Princeton, 1928; LL.D. (Hon.) Tulane University, 1928; F.R.C.S. Eng. (Hon.) 1927; F.A.C.S. (Vice President 1913–1920, President 1924–1925).

Widower. Established in New Orleans since graduation. Specialist in surgery since 1895; Professor of Surgery, Medical Department, Tulane University, 1895–1927 (Emeritus since 1928); Chief Senior Surgeon, Touro Infirmary, 1905– ; Charity Hospital Visiting Staff, 1880–1928 (Senior Surgeon, 1894–1928); Consulting Surgeon, 1928– ; Eye, Ear, Nose and Throat Hospital Consulting Surgeon, 1885– ; etc.

Major and Director, New Orleans School for Intensive Surgical War Training; Medical Officer, Reserve Corps, U.S.A., 1917–1918; Member, Louisiana Council National Defense, 1915–1918; Organizer and Director, Base Hospital No. 24 (Tulane Unit) for service in France, 1916–17; Member, Orleans Parish Medical Society, 1885; New Orleans Medical and Surgical Association (President 1889); Louisiana State Medical Society (President 1894–95); Honorary President, Pan-American Medical Congress, Washington, 1895 (Vice President for Louisiana, 1896); American Medical Association, Chairman, Section on Surgery, 1908; Vice President 1920; American Society of Clinical Surgery (Vice President, 1908–10); American Surgical Association (President, 1909); Southern Surgical Association (President, 1911; Honorary Fellow, 1928); American Association for Thoracic Surgery (President, 1920); Association of Military Surgeons, U.S.N.; American Association for Experimental Medicine; American Association of Anatomists; National Association for the Study and Prevention of Tuberculosis; American Association for Cancer Research; American Society for the Control of Cancer (Vice-Chairman A.C. 1926– ); American Association for Endocrinology; Fellow, New Orleans Academy of Sciences; American Association for the Advance of Sciences; Honorary Member, Illinois Central and Mississippi Valley R. R. Surgeons, 1910; Honorary Member, New York Academy of Medicine, 1920; Honorary Member, American Society of Regional Anesthesia, 1923; Honorary

* *Who's Who In America*, 1929–30.

Member, Boston Surgical Society, 1926; American Society History of Medicine, 1928; Honorary Member Philadelphia Academy of Surgery, 1929; National Institute of the Social Sciences, N. Y.; American Association Friends of Medical Progress; American National Economic League; Louisiana Historical Society; National Geographic Society; Southern Art League, U. S.; Art Association of New Orleans, La.; New Orleans Zoological Society; American Museum of Natural History, N. Y.; Member and Rapporteur on Arterial Surgery (Section on Surgery) International Medical Congress, London, 1913 (by invitation); Member Association Française de Chirurgie (Rapporteur, by invitation, Congress and Honorary President 1922); Corresponding Member, Société Nationale de Chirurgie, Paris, 1923; Member, Société Internationale de Chirurgie (Rapporteur, by invitation, International Surgical Congress, Warsaw, 1929); Honorary President, Surgical Society of Barcelona, Spain, 1927; Honorary Fellow, Royal Academy of Medicine, Rome, Italy, 1927; Honorary Fellow, Catalonian Academy of Medical Sciences, Barcelona, 1928; Member, Société Internationale pour l'Histoire de la Medicine, Paris, 1926; Corresponding Member, Peruvian Surgical Society, Lima, 1920; Officer with decoration, Order of Public Instruction, Republic of Venezuela, 1925; Knight, Civil Order of Alfonso XII, of Spain, with decoration, 1929.

Editor, *New Orleans Medical and Surgical Journal*, 1883–1895.

Greek Letter Societies: Stars and Bars, Tulane Honor Scholastic Society (President, 1922); Nu Sigma Nu, 1915; Alpha Omega Alpha, 1916; Kappa Delta Phi, 1925.

Henry Bigelow Medalist of the Boston Surgical Society, Boston, Mass., November 1, 1926. Clubs: Boston, Round Table, Italian American Society.

# A REPORT OF VASCULAR LESIONS

## WHICH ILLUSTRATE SOME OF THE FUNDAMENTAL PRINCIPLES THAT HAVE BEEN TAUGHT AND EMPHASIZED BY PROFESSOR RUDOLPH MATAS

A. ADVANTAGES OF THE REMOVABLE METALLIC BAND IN THE TREATMENT OF ANEURYSMS

B. LENGTHENED AND TORTUOUS ARTERIOSCLEROTIC ARTERIES, WHICH MAY SIMULATE TRUE ANEURYSMS

C. LIGATION OF THE THORACIC AORTA

D. EFFECT OF ARTERIOVENOUS FISTULAE UPON THE HEART

E. ARTERIAL DEGENERATION IN ASSOCIATION WITH ARTERIOVENOUS ANEURYSMS

F. COLLATERAL CIRCULATION IN CASES OF ARTERIOVENOUS ANEURYSMS

G. EFFECT OF CIRSOID ANEURYSMS AND VENOUS ANGIOMAS UPON THE GROWTH OF EXTREMITIES

H. ETIOLOGY OF CIRSOID ANEURYSMS

MONT R. REID, M.D.

CINCINNATI, OHIO

### INTRODUCTION

IN THE absence of any worthy experimental work or the use of new procedures in the surgery of the vascular system, I believe that I can best contribute my testimonial to this memorial volume by stressing and illustrating some of the important fundamental principles that have been, in a large measure, the fruit of Professor Matas's unmatched endeavor in this field. After all, he is the master of the knowledge, technique and history of vascular problems. In this field, as well as in many others, we turn to him for our knowledge and inspiration. The report of these cases in which I have both followed and not followed his teachings will, I hope, serve to point out the soundness of his wisdom in the handling of vascular conditions.

### A. ADVANTAGES OF THE REMOVABLE METALLIC BAND IN THE TREATMENT OF ANEURYSMS

The value of this method of occluding any large artery, when subsequent conditions might arise to make a restoration of function of the vessel very desirable or vital, has been taught by Professor Matas for many years and has been amply proved by his own experiences. Halsted (1906) devised an ingenious instrument for rolling the aluminum band about the artery to be occluded, and advocated rolling it further between the fingers until the desired occlusion was obtained. Matas and Allen (1911) adopted the method of flattening the band to the desired point of occlusion, and have proved the value of this modification of Halsted's idea. It is true that the rolled band occasionally results in the projection of the inner end of the band into the wall of the artery in such manner as to produce greater damage to the arterial wall, and the author has adopted the Matas-Allen modification. Whichever method is used, the fundamental principle in the application of the band is the production of the least possible damage to the arterial wall and especially to the intimal surfaces.

CASE 1. (M. 8420, Cincinnati General Hospital.) A colored man, aged twenty-nine, was admitted to the hospital on September 12, 1927, with a very pronounced pulsating exophthalmos of the right eye, which had resulted from a blow with brass knuckles behind the right ear four weeks previously. There was complete ophthalmoplegia due to the extreme exophthalmos. The eyelids were everted and edematous, the conjunctival veins were engorged and red, and the supraorbital veins were large. Vision was rapidly disappearing. A loud arteriovenous bruit could be heard over the entire head and the carotid vessels. Occlusion of the right common carotid artery by digital pressure caused a disappearance of the bruit and a marked recession of the exophthalmos. The rapid loss of vision and the youth of our patient caused us to decide on operation without waiting for or attempting to encourage the development of a collateral circulation.

September 13, 1927. The right external carotid artery was ligated with braided silk and the common carotid was gently occluded by a metallic band. The operation for some unknown and unjustified reason was done under ether anesthesia. The occlusion of the common carotid artery caused immediate cessation of the bruit and a recession of the eye. The operation

was done at 9 A.M. When I went on the ward at 5 P.M., the nurse reported that he had not "reacted" from the anesthetic. He was obviously comatose and completely paralyzed on the left side of his body. The band was

FIG. 1. Four months and twenty days after application of a rolled band to a dog's aorta. It was tightened until the thrill was very faint (not a complete occlusion). Note that the inner end of the band has cut through the wall and is projecting into the lumen.

immediately removed with an immediate return of the bruit. The bruit, however, grew fainter and was again completely absent at the end of five minutes. At the site of the band, above and below it, there was no evidence of a clot. Within three hours he began to show signs of consciousness and to move his left leg. At the end of five hours he was rational, could talk and was using his left arm and face to some extent. Improvement continued and at the end of twenty-four hours there was no evidence of any paralysis or cerebral disturbances. The bruit had not returned, the eye had ceased pulsating, the exophthalmos and edema had decreased markedly. On September 17 (five days after the operation), he was feeling so well that

FIG. 2. Patient with a tortuous and elongated arteriosclerotic innominate artery, which simulated a subclavian aneurysm.

he got out of bed and left the hospital against advice. No activity was demonstrable in the arteriovenous aneurysm and the eye had returned amazingly rapidly to an almost normal condition. For five days after leaving the hospital there was no noise in his head, he felt well and his eye had become "all right." He refused to be quiet and went to work. Then he was seized with a sudden severe headache, the noises in his head reappeared and his eye protruded very rapidly. Four days later when he was admitted to the hospital the condition was the same or a little worse than it was at the time of the first admission.

On September 27, 1927, under local anesthesia, the common carotid artery was again occluded by the removable metallic band and the jugular vein was ligated with a silk ligature. The artery was carefully examined. It was found patent and there was no evidence of injury at the site of the previous band. The operation was done at 9 A.M. and careful notes were made every half hour during the day. He seemed perfectly well until 4 P.M. when a slight weakness of his left face was noted but no disturbance in his extremities. At 5 P.M., he was slightly stuporous, the left arm and face were completely paralyzed, the left leg was not affected. The band was immediately removed with a complete restoration of the function of the artery. There was no evidence of clot formation within the vessel. The bruit and pulsation of the eye did not, however, return. The paralysis improved and was noticeable only by a weakness of the arm, face and leg on the evening of September 29. On the 30th, the paralysis was more obvious and continued to grow worse until on October 3rd, there was almost a complete left hemiplegia. Improvement then began and by October 26, he was able to walk and could not be persuaded to stay in the hospital. The left arm was still paralyzed, the leg partially paralyzed, but the aneurysm was apparently cured.

May 9, 1930, he was again admitted to the hospital with extensive bilateral pulmonary tuberculosis and died on May 24. The eye was normal and there was no evidence of an intracranial arteriovenous aneurysm. There was a spastic paralysis of the left arm; the leg and face had almost completely recovered. The common carotid artery pulsated normally and showed no evidence of occlusion. Unfortunately an autopsy was not obtained.

This case illustrates several important points. The value of using the removable metallic band is well demonstrated. In this instance, the common carotid artery was twice occluded with the flattened band and the band was twice removed without causing a thrombosis at either site of its application. The

FIG. 3. Case of elongated and tortuous arteriosclerotic innominate artery, which simulated a subclavian aneurysm. 1. Bifurcation of the innominate into the subclavian and common carotid arteries. 2. Innominate artery. 3. Jugular vein.

application of the first metallic band resulted in a complete hemiplegia, which promptly disappeared when the band was removed nine hours after its application. The application of the second band resulted in a partial hemiplegia which promptly improved when the band was removed after an interval of nine hours. However, at the end of three days the paralysis began to progress and at the end of six days there was almost a complete left hemiplegia. Recovery from this was slow and never complete; at the end of twenty months he still had a spastic paralysis of the left arm.

It seems to me that in this case the cerebral conditions resulted from two distinct causes. There was cerebral anemia which was twiced caused by occlusion of the common carotid artery, and which was twice relieved by restoring the lumen of this vessel. Secondly, there were cerebral disturbances due to clot formation at the site of the aneurysm and the propagation of this clot into other vessels. When the first band was removed, activity in the aneurysm was immediately restored but ceased suddenly in about five minutes. The hemiplegia disappeared completely in a few hours. There was evidently a local clot formation at the site of the fistula, which did not extend into other vessels. About ten days after this apparent cure of his condition the clot was dislodged with a sudden restoration of all of his old symptoms. When the second band was removed, no activity was ever detected in the aneurysm; the paralysis improved rapidly for a few days and then gradually became worse, resulting in a total hemiplegia. This was evidently due to an extensive thrombosis spreading from a thrombus at the site of the aneurysm for there could be no question as to the patency of the common carotid artery. The danger of propagating thrombosis from the clotting of aneurysms has been stressed by Professor Matas and is one of his arguments for a direct surgical attack on aneurysms whenever it is possible.

This case also demonstrates the importance of adhering to his teaching that the adequacy of a collateral circulation should

be proved before operating for aneurysms. I have in mind a similar case that was treated by Professor Matas. He taught the patient to compress his own carotid artery for varying lengths of time until he could compress it indefinitely without causing cerebral symptoms. One day the patient said that he was ready for the operation because he could compress his artery as long as he wanted to do it without causing any dizziness or other evidences of an inadequate collateral circulation. In the case reported, such a procedure would have avoided the cerebral complications resulting from occlusion of the common carotid artery if we had not felt that the rapid destruction of the eye did not justify the delay. The danger of what really caused his permanent disability, namely, the propagating thrombosis from the site of the aneurysm, would still have existed.

In this case, the ether anesthesia almost resulted in a failure to detect the hemiplegia. Local anesthesia is far more preferable when operating on the large blood vessels, especially the neck vessels, for it gives one ample time to make observations on the collateral circulation and it gives one the cooperation of his patient.

### B. LENGTHENED AND TORTUOUS ARTERIOSCLEROTIC ARTERIES, WHICH MAY SIMULATE TRUE ANEURYSMS

In my report of the aneurysms in The Johns Hopkins Hospital from the time of its opening to January, 1922, I included several cases in which a lengthened and tortuous sclerotic vessel was mistaken for a true aneurysm. In 1909, Dr. W. S. Halsted ligated the common carotid artery for what was considered an aneurysm of the innominate and subclavian arteries. The patient was a white woman, aged 60, who had a swelling 5 cm. in diameter just above the inner end of the clavicle. The Wassermann reaction was negative. Blood pressure, 220. Marked arteriosclerosis. For twelve years she was observed at frequent intervals and without noting any appreciable change in the condition. In 1921, we all agreed that the

condition had never been a true aneurysm, but simply a tortuosity of the subclavian and innominate arteries due to arteriosclerosis. Another similar case was recognized and not operated upon. In at least two other cases, one involving the common carotid artery, the other the subclavian, unnecessary operations were performed.

CASE II. About two years ago, a negro man, aged fifty-five (?), was admitted to the Cincinnati General Hospital with a diagnosis of a subclavian aneurysm. He had marked arteriosclerosis and a high blood pressure. The Wassermann reaction was negative. The swelling in the neck was due to a markedly lengthened and tortuous arteriosclerotic innominate artery, which had pushed up into and across the neck. The bifurcation of this vessel into the subclavian and common carotid arteries occurred at the junction of the middle and outer thirds of the clavicle. From this point, the carotid artery traversed the neck far lateral to the sternomastoid muscle instead of in its usual position near to the trachea.

### C. LIGATION OF THE HUMAN AORTA

Of all the attempts to ligate the aorta, very few have resulted in any benefit to human beings. Professor Matas' endeavor in this line has been noteworthy for its success. In view of his interest in this subject, I wish here to record two recent ligations of the thoracic aorta.

The technical procedure of ligating the aorta is not difficult, but the difficulty has been to ligate it in such manner as to result in a permanent occlusion of its lumen. Ligations with silk ligatures, tapes, bands, etc., have frequently cut through the arterial wall, resulting in a fatal hemorrhage or a re-establishment of the lumen within a few days or weeks after the operation. To avoid this danger, Dr. Halsted and I experimented with the use of fascial plugs that could be introduced into the lumen of the dog's aorta and there anchored. With this method we had uniform success. It is the method that was used in the two cases here reported.

CASE III. A negro woman, aged thirty-five years, was admitted to the Cincinnati General Hospital on July 11, 1928, with a luetic abdominal aneurysm. It arose from the posterior part of the aorta just above the

coeliac axis and was causing a marked erosion of the twelfth thoracic and first lumbar vertebrae. It also extended into the region of the left psoas muscle, causing the usual radiating pains into the left leg. The heart

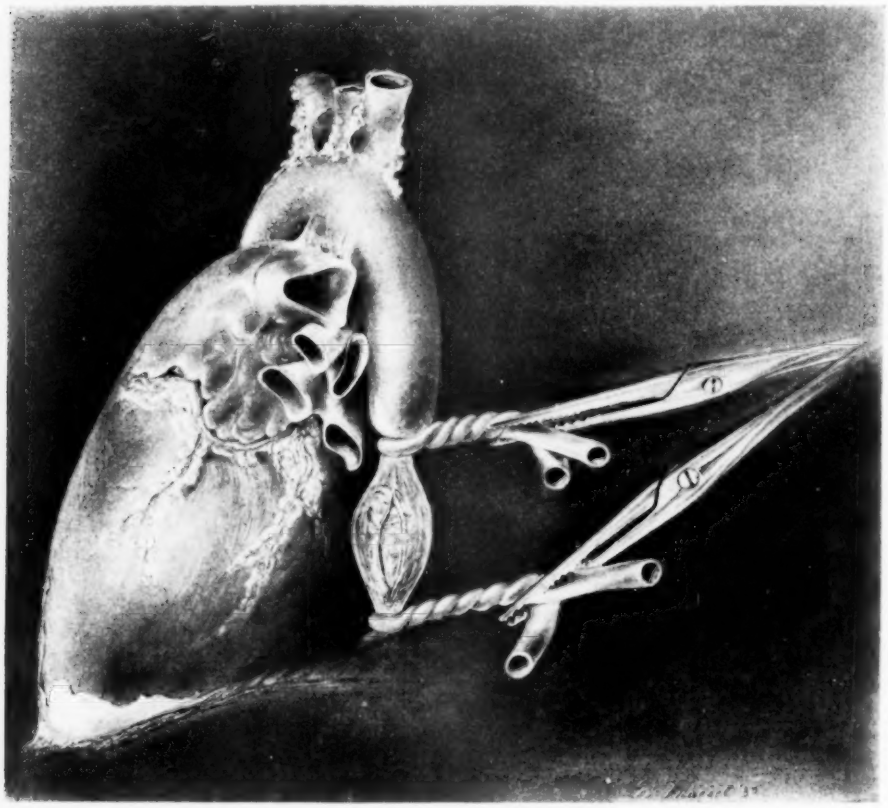


FIG. 4. Thoracic aorta temporarily occluded by rubber tubing, and the fascial plug in place ready to be sutured.

was not enlarged; pulse, 80 and regular, blood pressure 145/40; general condition, good.

With absolute bed rest for eighty days, during which time antiluetic treatment was given, the aneurysm grew definitely larger and more painful.

Operation, October 2, 1928. Intratracheal ether anesthesia was used. About 6 or 8 inches of the left ninth rib were excised. The parietal pleura was stripped from the chest wall for considerable distance. It was then opened. The ribs were spread far apart and this gave us an excellent exposure of the thoracic aorta. It was freed by means of staphylorrhaphes. The intercostal vessels coming off it were ligated with silk. The vessel did not seem particularly sclerotic; that is, it did not contain calicified

plaques in its wall. Some large tapes were introduced around the aorta and separated and twisted until the blood current was cut off. We watched the effect of this for some little time and had Dr. Morris watch the patient's pulse. After the aorta was thus occluded, the radial pulse became much stronger but the heart did not seem to dilate. Consequently we opened the aorta between the temporary occluding ligatures and filled it with a ball of fascia that had previously been taken from the right thigh by Dr. Bell. The ball of fascia was securely anchored in place by through-and-through mattress sutures of heavy braided silk. The opening in the aorta was closed with double medium silk sutures which included the fascial plug in them. On removal of the temporary ligatures of tape there was no bleeding at the point of operation. Everywhere the wound was dry and consequently it was closed tightly with interrupted silk sutures. The patient seemed to stand the operation surprisingly well.

The operation was done at 9 A.M. At 4 P.M. her general condition was very favorable. The pulse was of fairly good volume. The circulation in her legs seemed adequate, although no pulse could be felt in either extremity. At 6 P.M., evidences of shock began to develop; pulse 128; blood pressure, 90/70. In spite of stimulation and intravenous therapy this condition progressed until at 10 P.M., twelve hours after the operation, the patient died.

At autopsy, it was discovered that death had resulted from hemorrhage that came from the divided intercostal artery at the posterior part of our incision into the chest wall. No bleeding had occurred at the site of the occluded aorta. This vessel was removed and subjected to a high pressure of water without any leakage at the site of operation.

CASE IV. A negro man, aged fifty-seven years, was admitted to the Cincinnati General Hospital March 19, 1929, with an abdominal aneurysm. A diagnosis of an abdominal aneurysm had been made three years previously, but with antileutic treatment, the patient had been fairly comfortable and able to work until four months before admission. Then pain in his back and left leg forced him to become an inmate of the County Home for incurables. Clinically, the aneurysm was in the lower epigastric region, and extended into the left psoas region. Pulsation in the left lumbar region was easily detected. The left leg was flexed. The patient suffered excruciating pain. The right femoral pulse was absent; the left was apparently normal. The heart was normal in size, pulse 100, blood pressure 150/120.

Operation, May 17, 1929 (Dr. W. DeW. Andrus). Intratracheal ether anesthesia was used. An incision, about 6 inches long, was made on the right side of the chest, one inch lateral to the spinal column and extending

out along the tenth rib. The structures beneath this were incised and separated, the ribs were exposed and portions of about 5 inches of the ninth, tenth, and eleventh ribs were resected. The intercostal muscles and vessels were transfixed and ligated, the parietal pleura was stripped away. The aorta was exposed and two tapes were passed about it about 1½ inches apart. It was our plan to cut into the aorta and insert a plug of fascia lata which had been removed from the left thigh. The tapes were twisted down until the blood current was shut off. The blood pressure had been taken just before ligation of the aorta, and was found to be 130/100. Immediately following the obstruction of the blood current, it was found to be 180/130. The pulse was rather slow and became more bounding in the temporal artery. Upon making a longitudinal incision into the aorta the intimal coat was found to be so sclerotic that it exuded from the vessel. It was found to be impossible to place the fascial plug in position and suture the vessel over it, because the suture tore out of the vessel when any strength was placed upon it. The tapes which were already in place were therefore used and the aorta was ligated and divided between ligatures at the level of the eleventh thoracic vertebra. The wound was closed with interrupted medium silk sutures for the fascia and interrupted fine silk for the skin. No drainage.

The patient died, apparently from shock, about one and a half hours after the completion of the operation.

At autopsy about 400 c.c. of blood were found in the right pleural cavity although the parietal pleura appeared to be intact. No hemorrhage had occurred at either end of the ligated aorta.

### D. EFFECT OF ARTERIOVENOUS ANEURYSMS UPON THE HEART

I am very happy to report in detail in this volume an unusual case of cardiac disturbance following a femoral arteriovenous aneurysm, for, largely due to Professor Matas, the medical profession has become more thoroughly acquainted with the effect of this condition upon the heart. This report is made with the consent of Dr. V. R. Mason of Los Angeles, California, who immediately recognized the nature of his patient's trouble and asked me to come to California to operate for him. I have referred to this case in a brief footnote in the chapter on the surgery of the Arteries in Nelson's Loose Leaf Surgery.

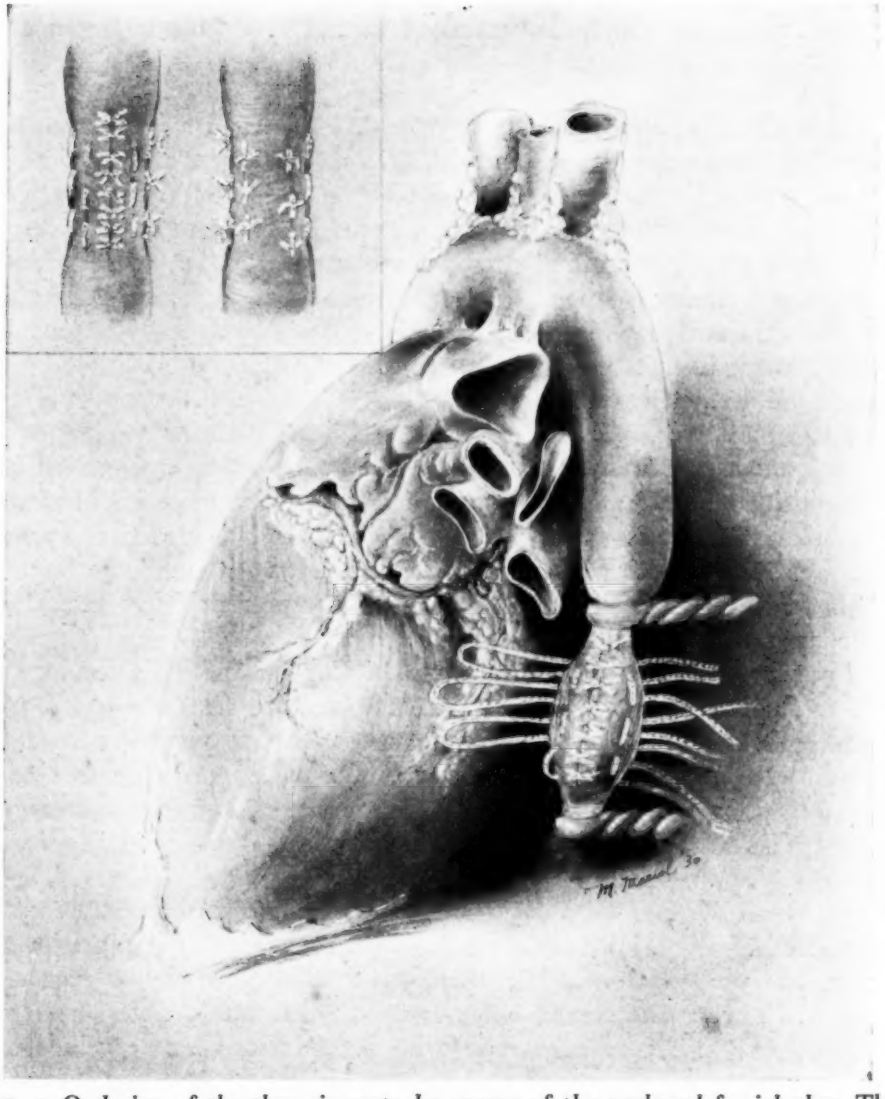


FIG. 5. Occlusion of the thoracic aorta by means of the anchored fascial plug. The incision into the aorta has been sutured. The through-and-through mattress sutures of silk are ready to be tied. Insert shows the anterior and posterior views of the completed operation.

On his first visit, June 26, 1928, Dr. Mason made the following note:

CASE V. The patient is undernourished. The lips are very red but not cyanotic. The skin is clear. No angiomata. The sclerae are a bit subicteric. The lungs were not examined. The veins of the neck are full in every position. The veins on the back of the hand collapse about 12 cm. above the heart level. At about 10 cm. they pulsate noticeably. Heart, apparently absolutely irregular but not just like the ordinary atrial fibrillation. Relative cardiac dulness in about 13 × 6 to 7 cm. It is definitely a globular heart. No significant murmurs. Abdomen is distended with fluid. No viscera are felt. There is moderate edema of the legs, especially of the right. Just over Scarpa's triangle is a fusiform pulsating swelling over which is a continuous thrill, felt to the end of the toes. Over this there is a loud continuous murmur accentuated at systole. The pulse is about 100. The blood pressure is 150/60; when the fistula is occluded it is 155/90. This was repeated with essentially similar results. Although the force of the beats varies, I believe that these results represent fairly accurately the change when the fistula is closed.

*Impression.* 1. Arteriovenous fistula. 2. Cardiac failure, secondary to No. 1. June 29, 1928, blood pressure, 160/70 with fistula open; 165/90 with fistula closed. The patient's abdomen was tapped and about 8 quarts of fluid were removed. After the tapping, the blood pressure was 130/65 with the fistula open; 140/80 with the fistula closed. The liver is enlarged. The edge is about two fingerbreadths below the costal margin. It is smooth, not definitely pulsating.

*Electrocardiogram.* July 1, 1928. Atrial fibrillation of the fine type. No spaced P waves. Low voltage in lead III. $T_3$ inverted. $T_1T_2$ upright. No ventricular preponderance. No slurring nor splintering of QRS except in lead III. Lead I: with fistula open, rate 90; with fistula closed, rate 78; Lead II: with fistula open, rate 90; with fistula closed, rate 90; Lead III: with fistula open, rate 97.5; with fistula closed, rate 84. The lungs are clear except for numerous râles over the right upper chest. The *x*-ray of the chest shows some fibrosis and a moderately large globular heart.

When I arrived in Los Angeles, Dr. G. H. Ernsberger who had assisted at a previous operation and who had observed the patient ever since, gave me the following notes:

*Complaints.* Swelling of the abdomen and legs, especially the right one; feelings of fullness in the head; easily fatigued; thrill that can be felt in the upper part of the right thigh.

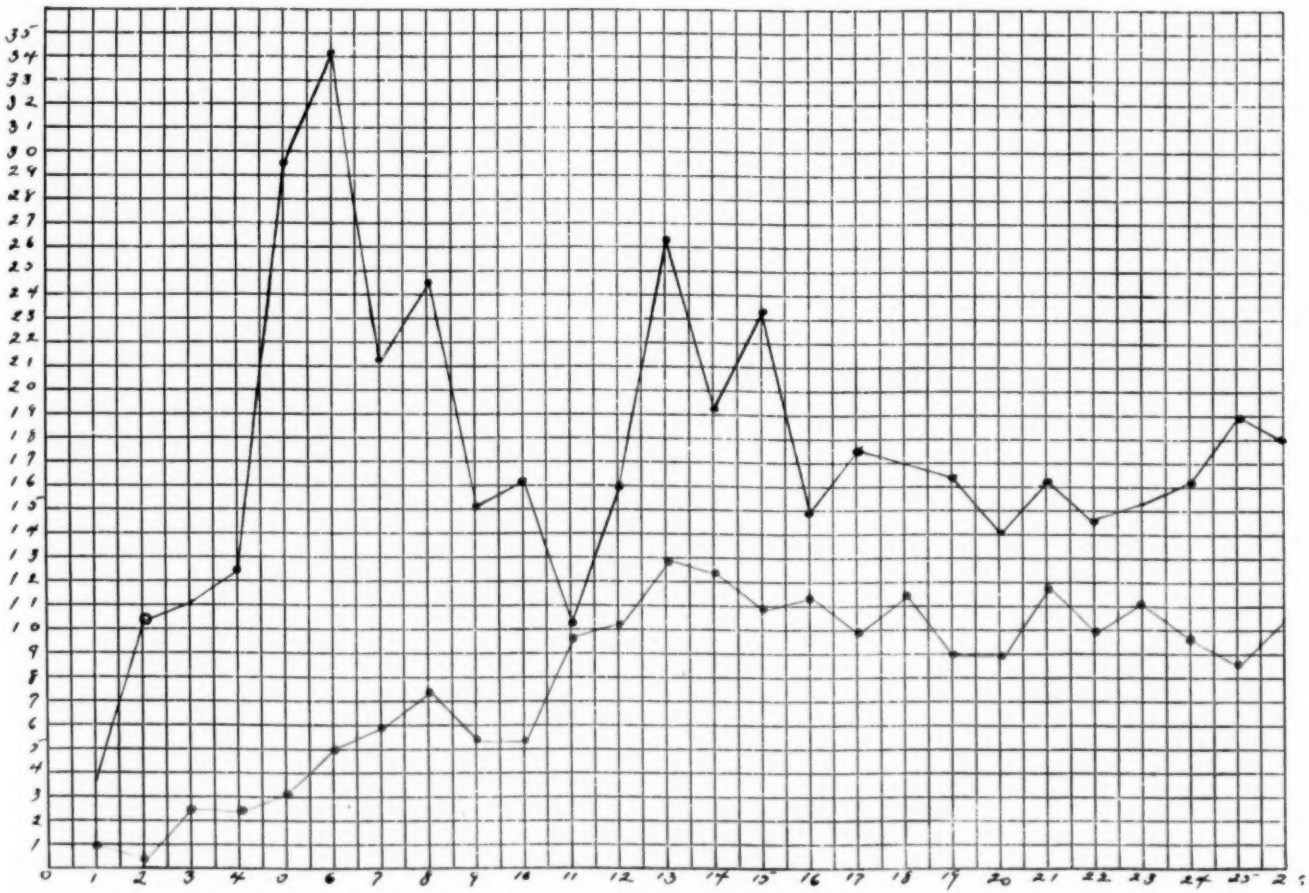


FIG. 6. The fluid intake (red) and urinary output (black) are charted for twenty-six days following operation. On the sixth day the urinary excretion was 3400 c.c., the fluid intake, 500 c.c. On the eleventh day the intake and output were almost the same, and it was on this day that the wound was opened because of infection. Note the gradual fall of urinary excretion before and the sudden rise after the drainage of the infection.

On August 13, 1924, the patient was shot through the right thigh from back to front, just above the middle, with a 38/ revolver. The wound bled at the time, but not profusely. Eight days later a pulsating expansile tumor was found beneath the wound of exit. This enlarged rather rapidly for about four weeks and then remained stationary in size, being approximately 6 cm. in diameter. Over the tumor mass there was a systolic thrill, and a thrill could be felt along Hunter's canal and as high as Poupart's ligament. There was a characteristic aneurysmal bruit audible over the same area. The posterior tibial artery on this side was palpable only when the swelling was compressed. There was no edema of the right leg. These were the findings as they existed on September 30, 1924 when he was operated upon by Dr. Roland E. Skeel. His physical examination other than the foregoing showed no important abnormalities. The condition of his heart was good, showing no signs of decompensation; his blood pressure was 140/90.

At the operation there was found an aneurysmal sac arising from a vein which was anterior to the superficial femoral artery. There was an opening between the posterior surface of this vein and the anterior surface of the artery. This venous sac was about the size of a walnut and had dissected its way directly into the body of the sartorius muscle. A tourniquet was applied above the site of the operation and the opening of the vein into the sac was sutured with fine silk and, after separating the vein and artery, the communicating openings were also sutured with fine silk. The vein in question was tied below the point where it crossed the artery. The muscles were sutured over the repaired vessels.

On October 5, there was found to be a distinct thrill from Poupart's ligament to the middle of Hunter's canal when slight pressure was made over the wound, but when very light touch was used no thrill could be felt. There was no expansile pulsation and the circulation in the foot was good. The wound healed with no infection, but there was a small amount of blood and serum evacuated on the ninth day. The thrill continued to be felt during the next two weeks while he remained in the hospital, but did not seem to increase.

On October 15, a note was made that the posterior tibial artery was distinctly palpable without pressure being made over the wound. There was some swelling of the right leg when the patient got out of bed about November 15.

During the past four years this thrill has persisted, and has increased in intensity. There has been a moderate increase of swelling of the right leg. The patient had not been inconvenienced by pain or other unusual symptoms until December 15, 1927, when he became ill with an attack of influenza, subsequent to which he developed a fibrillating heart, edema of both legs and abdominal ascites.

In January last, he was put to bed and has remained in bed since then. With large doses of digitalis and a limited amount of fluids, the heart condition has improved and the general tissue fluids have diminished but the fibrillation has continued almost constantly since that time, as has the ascites for which he has been tapped several times. The urine during the past four years has shown a slight to a heavy trace of albumin and a few hyaline casts. His blood pressure has remained fairly constant at about 140/90. Occasionally the blood pressure has been found to be as high as 160, sometimes as low as 120.

The following note was made by me on July 11, 1928:

The patient is a white man, fifty-seven years old, presenting the picture of rather extreme circulatory failure. The eyelids are puffy; face, slightly swollen and subicteric in color; lips and mucus membranes definitely cyanotic; veins of the neck, distended and pulsating; slight but definite generalized edema of the extremities; very marked ascites; a large fibrillating heart. The story is that on August 12, 1924, he was shot through the right thigh with a 38/ revolver, which established a communication between the femoral artery and vein (arteriovenous aneurysm). On September 30, 1924 (about six weeks after the accident) an unsuccessful attempt to close this fistula was made. The records show that at that time his heart was regarded as normal. In the four years since then he has developed a very large fibrillating heart associated with decompensation and ascites as noted above and more carefully in the notes of Dr. Mason and Dr. Ernsberger. Several abdominal tappings, with the withdrawal of as much as 18 liters of fluid, have been necessary. There is a well-healed scar over the right Scarpa's triangle, measuring about 7 inches in length. There are the evidences of a large arteriovenous communication between the femoral vessels at about half the distance between the profunda artery and the apex of the triangle. The thrill and continuous bruit are easily detected all the way to the foot and upward to the bifurcation of the aorta. The bruit can also be heard in the left femoral artery. They are most intense directly over the fistula. Occlusion of the fistula makes them disappear entirely. At the site of the fistula, there appears to be an aneurysmal dilatation about the size of an egg. Whether this is on the artery or vein I cannot say. The artery proximal to the fistula is tremendously dilated all the way to the bifurcation of the aorta and this latter vessel is almost certainly dilated but cannot be demonstrated on account of the ascites. At Poupart's ligament the femoral artery is at least four times larger than normal. This vessel is a little tortuous. There is not a marked angiomatous condition in the subcutaneous tissues, due probably to the location of the fistula and the fact that the long saphenous vein was certainly sacrificed

at the first operation. There is considerable edema of the right leg (more than in the left). Below the knee there is rather marked pigmentation of the skin but no ulceration or scars indicative of previous ulcers. The pulse in the foot is easily felt but it is smaller in volume than it is in the opposite foot. Occlusion of the femoral vessel at the site of the fistula increases the volume of the pedal pulses. The effect of this maneuver on the heart, pulse rate and general blood pressure is carefully recorded by Dr. Mason. The right foot feels a little colder than the left. The general venous pressure is obviously elevated as noted by the dilated veins in the neck and extremities and by the fact that the superficial veins do not collapse until the extremities are raised well above the level of the heart. This is not true when the fistula is closed by compression. The artery beyond the fistula cannot be felt and is obviously small. The fistula is on a line directly between the scars of the points of entrance and exit of the bullet.

*Impression.* A large right femoral arteriovenous aneurysm of four years duration, which has resulted in a large fibrillating heart and general anasarca due to decompensation of the heart.

*Recommendation.* The segments'of artery and vein bearing the fistula should be completely excised. There is already an adequate collateral circulation as shown by the effect on the pedal pulses of occluding the femoral artery. The femoral artery is obviously markedly degenerated and no effot to restore it to function should be made.

*Operation July 12, 1928.* The operation was done without a tourniquet and under local anesthesia. Due to the scar tissue from the previous operation and the great vascularity the time required to complete it was over three hours. We excised the artery and vein at the site of the fistula and ligated the four ends of the divided vessels with heavy braided silk. The wound was closed without drainage.

The artery proximal to the fistula was four times as large as the distal portion. The vein was markedly enlarged, especially on the cardiac side of the fistula. The fistulous opening measured 1.5 cm. in diameter. The artery below the fistula, the wall of the vein opposite it and the edges of the communication showed a marked sclerosis with calcification. The artery proximal to the fistula was extremely thin-walled and resembled a vein. This large opening, together with the previous ligation of the distal vein, allowed an unusually free shunting of the arterial blood back upon the heart. After the operation was completed, the dorsalis pedis pulse was apparently as good as in the opposite foot.

Ten days after the operation it was necessary to open the wound because of a mild staphylococcus infection. It was opened widely and Dakinized very freely for about two weeks. Complete healing occurred without sloughing or a discharge of the heavy braided silk sutures.

There was an astonishingly quick change in the condition of the patient following operation. By evening of the day of the operation, the cyanosis had disappeared, the veins of the neck were collapsed and the heart was perceptibly smaller and more regular in action. From day to day, the decrease in the size of the heart was very striking and in less than a month it had reduced in size from a large heart to one of almost normal size. At that time there was, however, some atrial fibrillation still present. The temperature of the right foot was strikingly elevated for several weeks after closure of the fistula. The pedal pulses remained as good as they were in the other foot.

A most astounding effect of the operation was the rapidity of the disappearance of the anasarca. Beginning on the day of operation, the urinary output far exceeded the fluid intake; on the fourth day this amount was almost five times as great as the amount he drank. By the tenth day he had lost nearly 50 pounds in weight, due almost entirely to the excessive urinary excretion. The patient complained that he had to void so frequently he could not sleep. In a week the tremendous ascites was practically gone and the intestinal patterns could be seen through the relaxed and thinned abdominal wall. Due to loss of fluids the patient's face and extremities seemed emaciated; the skin became relaxed and wrinkled.

The operation was done on July 12, 1928. For about six months prior to this, he had been bedridden and tapped frequently under the impression that he had a hopeless case of cirrhosis of the liver. In the late autumn after the operation, he reported to me that he was able to attend to his usual duties and to play golf. I have never seen nor heard of such a damaged heart due to an arteriovenous aneurysm nor such a remarkable recovery after its removal.

A fuller report by Dr. V. R. Mason, giving careful electrocardiographic studies of the heart and chemical studies of the urine and blood will certainly appear before long.

### E. VASCULAR DEGENERATION IN ASSOCIATION WITH ARTERIOVENOUS ANEURYSMS

The artery proximal to a fistula tends to degeneration; its walls become thinned, muscular and elastic tissues atrophy, and in many cases it assumes the appearance of a vein. I have cited reports in which aneurysms have developed in this proximal vessel. In one case an aneurysm developed in the proximal artery six years after the closure of a fistula, with restoration of the artery and vein. The wall of the involved

vein becomes thicker and hypertrophied. I have previously suggested[1] that the alterations in the pulse pressure might be responsible for this atrophy of the artery and hypertrophy of

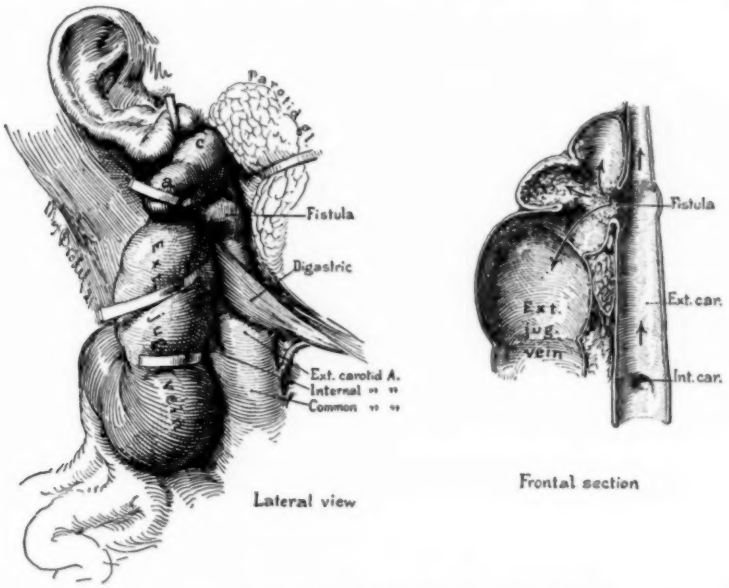



FIG. 7. Arteriovenous aneurysm which had been present for thirty-two years. Age of patient, thirty-four years. Note calcification of vein, and relative thinness of arterial wall as compared with that of the vein.

the vein. Certainly, some fundamental principle, such as nutrition of the vessel walls or exercise, is involved in these changes.

In addition to the foregoing changes, there is usually a very marked deposition of calcium in the rim of the fistula and especially in the wall of the vein directly opposite to the fistula. This was very pronounced in the case of a thirty-four year old woman who had had a fistula between the external carotid artery and external jugular vein for thirty-two years. There was no evidence of any other arteriosclerosis.

### F. THE COLLATERAL CIRCULATION IN CASES OF ARTERIOVENOUS ANEURYSMS

A great many years ago Professor Matas observed a very rapid return of a peripheral pulse after the tying of both artery

[1] *Arch. Surg.*, 2: 24–42 (July) 1925.

and vein for an arteriovenous aneurysm. In Holman's remarkable case, an absent pulse in the foot could be made to appear and become strong simply by compressing the arteriovenous

FIG. 8. Injection preparation showing effect of an arteriovenous fistula on the development of collateral circulation in the dog. An arteriovenous fistula was established between the femoral artery and vein on the right, while the left femoral artery was ligated at the same level. Duration of experiment, five months.

fistula. In one of my patients who had had a femoral arteriovenous aneurysm for nine years, no pulse could be felt in the foot. Immediately after excision of the aneurysm (artery and vein)

a good pulse appeared in both the dorsalis pedis and posterior tibial arteries; within twenty-four hours, the pulse in this foot was actually fuller and stronger than it was in the normal foot. Observations of a similar nature have been made by Gehle and Keys, Krammerer and, more recently, by many others.

These observations led me to attempt to demonstrate experimentally the effect of arteriovenous fistula upon the collateral circulation. We have made these experiments upon a great many dogs and have *x*-rayed the arterial system, after closure of the fistula, at varying lengths of time following the operations. In from three to six months, an enormous collateral circulation develops. It is many times greater than in the leg when a simple ligation of the artery or of the artery and vein is done. The embarrassment to circulation following an arteriovenous aneurysm would seem to be much greater than that due to an occlusion of the artery, and consequently, the cause of a much more prodigious development of a collateral circulation. For this reason, we counsel delay in operating on arteriovenous aneurysms whenever the effect on the heart, or, for purely local reasons, an immediate operation is not demanded. After five or six months, the operation is technically easier and the involved vessels may be sacrificed without fear of an inadequate circulation.

In cases of arteriovenous aneurysms, when a direct attack on the fistula is ultimately contemplated, we do not believe that artificial means to stimulate a collateral circulation are indicated. The greatest stimulus is already present. In cases of pulsating exophthalmos, when a direct attack on the fistula is not possible and when one cannot always wait long, the situation is different. Here one is reduced to the notoriously dangerous procedure of ligating an artery proximal to an arteriovenous aneurysm. In such cases, Matas' method of testing whether the artery can be ligated should be done. It is entirely possible that a proximal ligation of the artery is more dangerous in old cases than it is very shortly after the fistula is produced.

## G. THE EFFECT OF CIRSOID ANEURYSMS AND ANGIOMATA ON THE GROWTH OF EXTREMITIES

As far back as 1854, Giraldes noted the lengthening of a limb in a case of cirsoid aneurysm. Ten and thirteen years later, similar observations were made by Cordonnier and Hewett. In this century several observers have confirmed these earlier reports, so that now the overgrowth of an extremity involved in a cirsoid aneurysm is fairly well known to any surgeon interested in vascular conditions. The fundamental reason is the more than normal supply of arterial blood to an extremity during its period of growth. So far as I can learn there has not been reported an overgrowth of bone when the cirsoid aneurysm has occurred after ossification of the epiphyseal lines. In this connection the late Professor Halsted was always interested in the lengthening of bones in cases of chronic osteomyelitis of children. We measured and studied several cases in which the bones of the affected legs were several centimeters longer than the corresponding normal bones. It was our belief that the increased blood supply due to the prolonged inflammation was responsible for the excessive growth.

If over-arterialization will cause overgrowth of a part, then it would appear reasonable to expect undergrowth of a part in some cases of venous stasis. There are cases of extensive venous angiomata in which the capillary bed is apparently normal, and in which nutrition of the part is probably below normal. In many respects, this condition is directly opposite to the condition that prevails in cases of cirsoid aneurysms. In 1925, I gave a short abstract of a case in which retarded growth was associated with an extensive venous angioma of the leg. The patient was then thirteen years old. I wish now to present some further observations upon this case, and, in order to contrast it with the effects of over-arterialization I will summarize a previously reported case of cirsoid aneurysm.

CASE VI. In 1921, I operated upon a white woman, aged thirty-five, who had had a cirsoid aneurysm of the entire right lower leg since birth.

Throughout the tibia there were numerous free communications between the arteries and veins and all of the large superficial veins pulsated and carried arterial blood. This case has previously been reported in detail[1]

FIG. 9. A congenital cirsoid aneurysm of the right leg. Age of patient, thirty-five years. Right tibia was 5.75 cm. longer than the left. All of the bones of this leg were larger than those of the other leg.

but I wish here to call attention to the fact that the right leg measured in length 6 cm. more than the left leg. The actual length of the right tibia was 5.75 cm. longer than the left.

The case of venous angioma was first seen by me December 10, 1923. At that time, the following note was made:

[1] *Arch. Surg.*, 10: 601–638 (March) 1925.

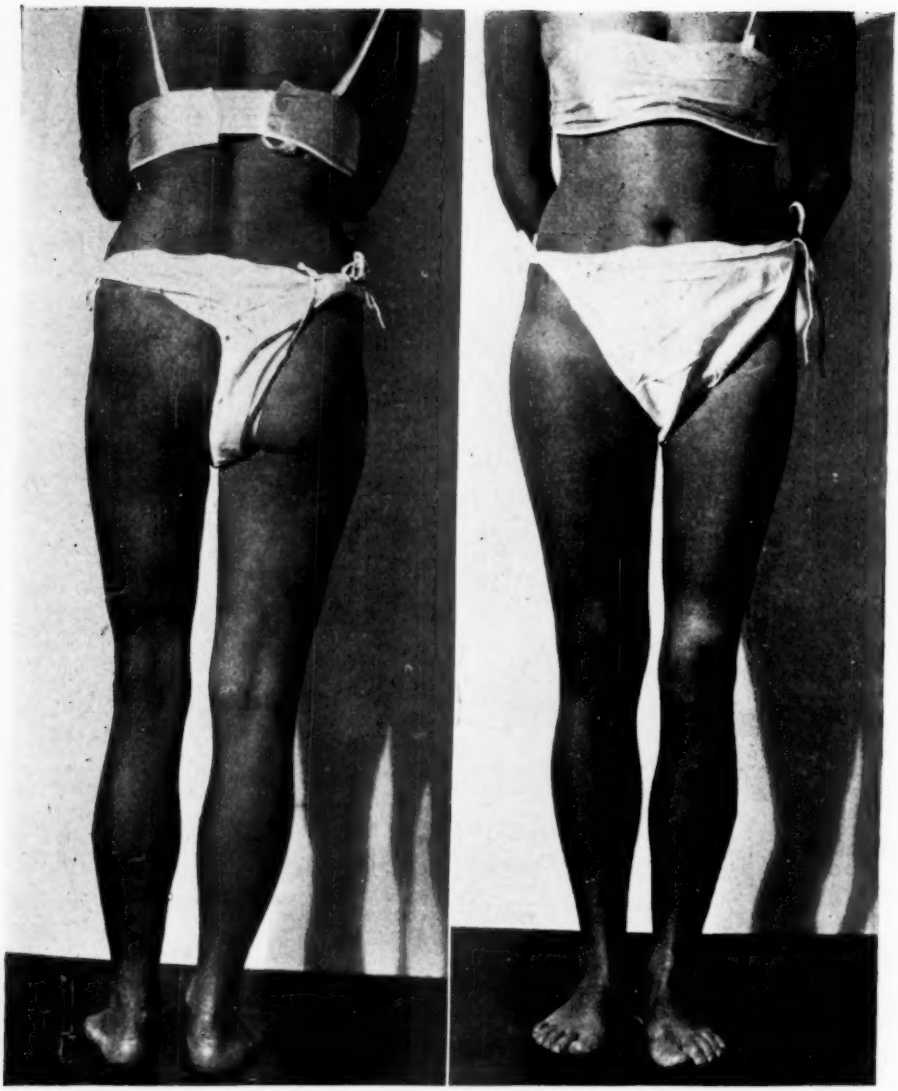


FIG. 10. Anterior and posterior views of patient with a venous angioma of the left leg. Note lack of development of this leg. Surface croppings of the angioma can be seen in the toes and over the buttock.

CASE VII. The girl, aged thirteen, was born with a bluish discoloration of the heel and outer aspect of the foot and the posterior part of the leg all the way to the buttock. Very little attention was paid to this condition until, at the age of four, the child developed trouble with the left knee. As a result she was given a series of nine or ten roentgen-ray treatments without any beneficial effect. Since that time she had had numerous attacks of disability in the left knee, which often necessitated her staying in bed for several days or weeks. There was no history of chills, fever or vomiting associated with these attacks; nor do they follow as a result of localized infection, such as tonsillitis. It had been noted by her friends that she limped and that the left leg was a little shorter than the right.

The examination showed that the entire left leg and foot were smaller than the right. The left leg was much paler than the right, except at points where the angiomatous condition came to the surface.

The following measurements were made: Left tibia, 34.25 cm.; right tibia, 35.25 cm. left femur from trochanter to condyle, 35.5 cm.; right femur from trochanter to condyle, 39.25 cm. Anterior superior spine to internal malleolus, left, 81 cm.; right, 82.5 cm. Circumference of calf, left, 29 cm.; right, 32 cm. Left knee, 28.5 cm.; right knee, 31.25 cm. Left thigh (measuring 9½ inches (24 cm.)) above knee, 40 cm.; right thigh, (measuring 9½ inches (24 cm.)) above knee, 44 cm. Length of sole of foot, left 22.5 cm.; right, 23.5 cm.

A very interesting point was that the child complained very frequently of being dizzy when she assumed a standing position after lying down. This is slightly present now on examination. It is very likely that when she stands up suddenly a great deal of blood is shunted into the angiomatous area so that the dizziness is due to anemia of the brain.

October 13, 1930. The patient is now twenty years old. About once a year she is incapacitated for a week or ten days because of haemorrhage into the knee joint. The rest of the time her activities are not especially limited.

The surface appearances of the angioma in the foot, posterior part of the leg and thigh and over the buttock, do not seem to have progressed in the last seven years. The contrast in size of the two legs is more marked. The left foot is strikingly smaller than the right; the entire left leg appears much smaller and shorter. The muscles of the left thigh and calf are much softer and more flabby than those of the right leg. However, when the patient stands the blood vessels become distended and cause the muscles of the left leg to appear much firmer. Muscular strength in the left leg is definitely reduced. Due to the shortness of the left leg the patient walks with a little tilt of the pelvis, but without any noticeable limp.

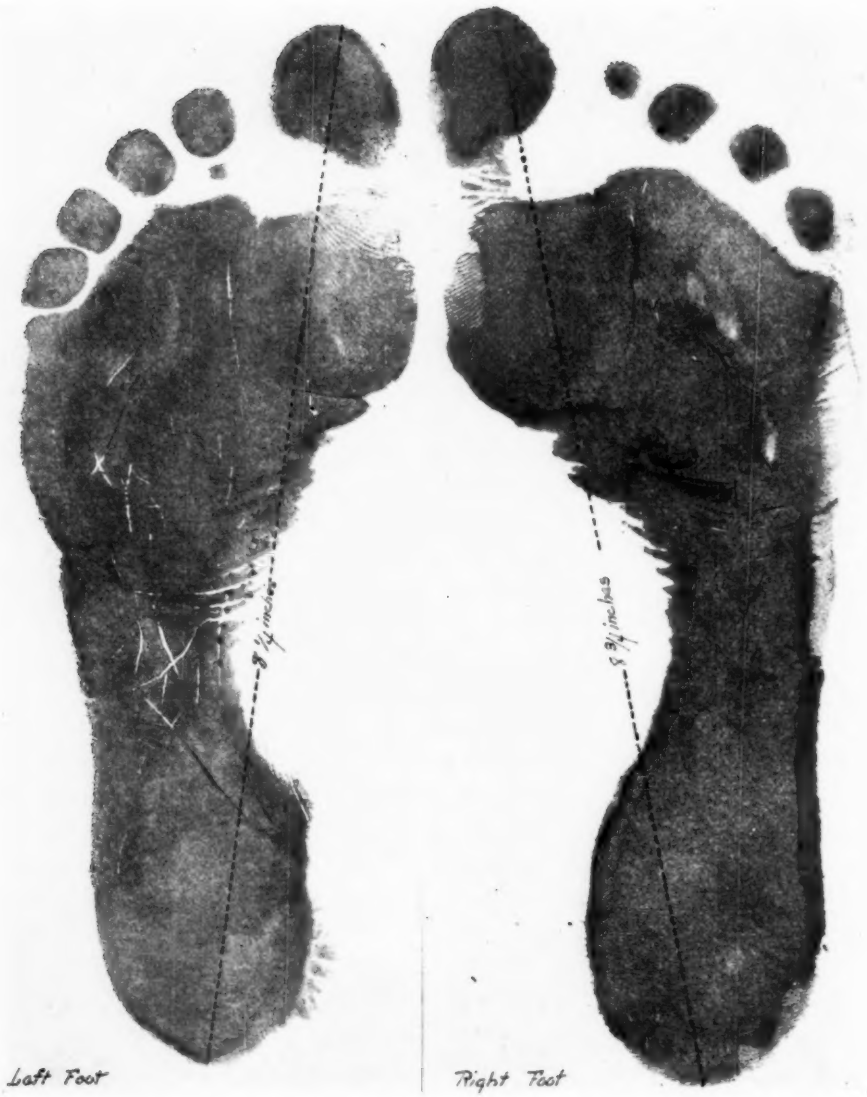



FIG. 11. Foot prints of the patient with atrophy of left leg due to an extensive venous angioma. The sole of the left foot is ½ inch shorter than that of the right foot. Prints made October 16, 1930.

The following measurements were made. Left tibia, 34 cm.; right 36½ cm. Left femur from trochanter to condyle 40 cm.; right, 40 cm. Anterior superior spine to internal malleolus, left 83 cm.; right 84 cm.

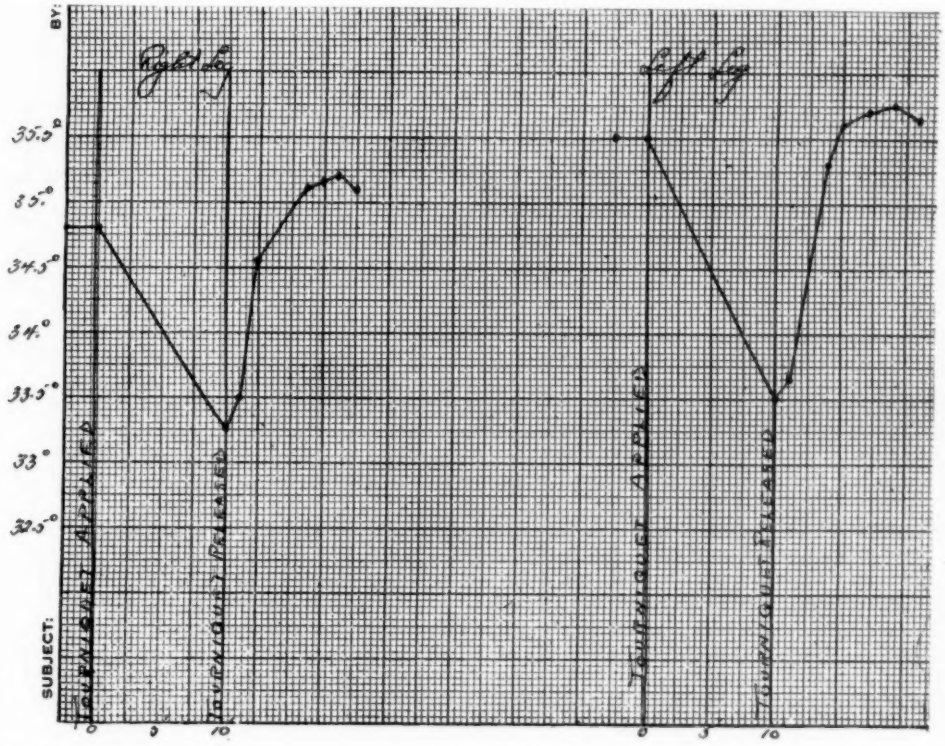



FIG. 12. Studies of the temperature by means of the thermocouple in the case of congenital venous angioma of the leg. Temperature of the left leg is normally a little higher than it is in the right one. However, it drops more rapidly and rises more slowly and relatively less high with the application and release of the tourniquet.

Circumference of calf, left, 31 cm., right 33 cm.; left knee, 27 cm., right 32½ cm.; left thigh (24 cm. above the knee), 44½ cm., right 49½ cm. Length of sole of foot, left 20 cm., right, 24 cm. From these measurements it would appear that the left foot is even a little smaller than it was seven years ago.

With the patient lying down, the blood pressure is 130/85 and the pulse rate is 86. Immediately after standing the blood pressure is 126/84, the pulse 116, and there is slight dizziness, but this is not as noticeable as it used to be. After standing for ten minutes, the pulse rate drops to 104. Immediately after lying down and holding both feet up in the air the pulse rate becomes 88; the blood pressure remains 130/84. In the recumbent position the blood pressure in the left leg is 134/85, in the right leg, 165/125.

Observations on the temperatures of the two legs are made by means of the thermocouple (see Fig. 12).

It seems certain that the impaired circulation is due to the venous angioma and that, as a result of poor nourishment, the left leg has failed to develop normally. This is in quite striking contrast to the over-development that may result from cirsoid aneurysms. In this case the capillary bed is probably normal but the large angioma on the venous side of it definitely embarrasses circulation. In cirsoid aneurysms, there is an overabundance of arterial blood without any obstruction to venous return.

### H. THE ETIOLOGY OF CIRSOID ANEURYSMS

In other papers I have discussed at length and have cited many instances in support of my conviction that cirsoid aneurysms and arteriovenous aneurysms are essentially the same condition and result from the same etiologic factors. They are both abnormal arteriovenous communications and may be either traumatic or congenital in origin. I wish here to report two more cases of cirsoid aneurysms which were the direct result of trauma. In one case the cause was a contusion, in the other it was a penetrating wound.

CASE VIII. A white girl, aged twenty-nine, was first admitted to the hospital in April 1928, complaining of a swollen reddish area on the dorsum of the right foot. Until the age of seven, both feet were normal. At that time a porch bench was dropped on her right foot. The skin was not broken, but there resulted a marked swelling and extensive ecchymosis. With the subsidence of these signs it was noted that a little swelling persisted on the dorsum of the foot just at the site of the blow. During the succeeding twenty-two years, or up to the time that I first saw her, this small area grew slowly in size, became reddish in color and in recent months had given rise to occasional severe hemorrhages.

On the dorsum of the foot there was a reddish warty or telangiectatic area about the size of a silver dollar. This area pulsated and over it a faint systolic thrill could be felt. The veins of the foot were markedly dilated, pulsated and obviously carried arterial blood. A loud continuous bruit with systolic intensification could be heard over the entire foot. This was most pronounced over the red area where firm pressure appeared to

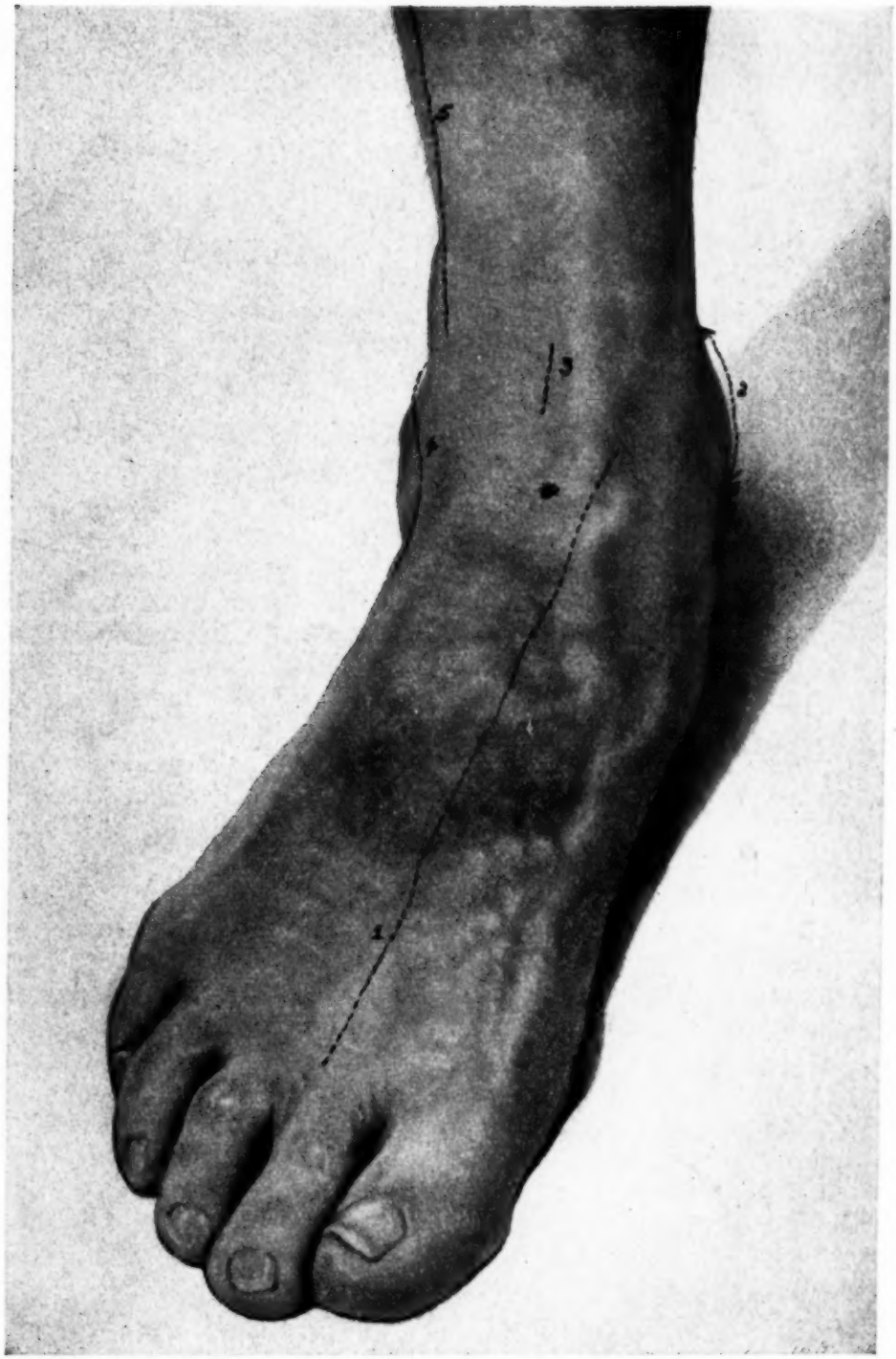


FIG. 13. Case of cirsoid aneurysm caused by a blow on the dorsum of the foot. Age of patient, thirty years. Duration of aneurysm, twenty-three years. The dotted lines represent the sites of the five operations. The stars represent the two points where bruits can now be heard.

obliterate completely the thrill and bruit, and resulted in a collapse of the veins with a cessation of their pulsation. The dorsalis pedis, anterior and posterior tibial arteries appeared to be fully two or three times their normal size. The popliteal artery was not demonstrably enlarged. The blood pressure in the right thigh was 160/130, in the left 130/80, in either arm it was about 112/80. The right foot was definitely longer and larger than the left one. She had to buy shoes a size too large for the left foot in order to have the right foot fitted. The foot, ankle and lower part of the leg were warmer than the corresponding parts of the other leg, and exhibited a more luxurious growth of hair. X-ray of the foot revealed no abnormalities of the bones.

Operation was performed under ether anesthesia, April 28, 1928. As is customary in any vascular case, the skin was sterilized with iodine and then covered with collodionized china silk. A tourniquet was applied to the thigh. Through a straight dorsal incision the subcutaneous vessels including the dorsal pedis artery were removed. They were found to be intimately connected with the tendons and large thin-walled vessels extended in between the bones of the foot and ankle. Bleeding points were ligated with silk ligatures and the wound was closed with silk sutures.

About one week after this operation, a faint bruit was detected over the outer side of the foot and about the ankle. Occlusion of the posterior tibial artery seemed to stop it. On May 12, 1928, this vessel was ligated under local anesthesia. A couple of days later the bruit was still audible and on May 16, a large branch of the anterior tibial artery just above the ankle was also ligated. Following this and up to the time the patient left the hospital, there were no definite evidences of any abnormal arteriovenous communications.

February 23, 1929, the patient was again admitted to the hospital for study and treatment. She had been working regularly for almost nine months when a little swelling and subsequent oozing of a pale colored fluid had developed at the lower end of the scar. On examination a small infected stitch was removed from this point, with the result of a very prompt healing. o Npulsation, thrill or bruit could be detected in the region of the discolored area. However, on the lateral aspect of the dorsum of the foot and extending up toward the external malleolus a faint but distinct bruit could be heard. Just anterior to the external malleolus a rather large artery could be felt, occlusion of which caused the bruit to disappear. On February 28, this vessel was exposed and about 2½ inches of it removed. It extended under the annular ligament, was as large as a normal dorsalis pedis artery and seemed to us to anastamose definitely with veins. She remained in the hospital eighteen days. During this time a bruit was not heard. Examination after she had been on her feet for twelve

days revealed a faint bruit on the inner side of the ankle joint and about the heel.

April 1, 1929, an incision 3 inches long was made just above the external malleolus and parallel to the tendo Achillis. Through this incision we again ligated the posterior tibial artery and excised a large aberrant branch of the anterior tibial running just behind the fibula. A week later the patient was again discharged from the hospital with no audible arteriovenous communication present. No distended and pulsating veins had ever developed since the first operation.

September 18, 1930. Since being in the hospital, the patient has been very comfortable and has carried on her work without any difficulty until the last two or three days when there has developed a little redness, swelling and soreness on the outer side of the dorsum of the foot. The dorsum of the foot is still slightly reddened, hot and shows definite evidences of mild infection. There is no fluctuation and it appears that the infection may subside. The veins of the foot and ankle are still slightly dilated when she stands. When she lies down, they collapse entirely except just in front of the ankle joint. No thrill can be felt anywhere. There is no bruit to be heard over the foot. However, a distinct systolic bruit can be heard in front of the ankle on a level with the malleoli, and just below the internal malleolus. The anterior tibial artery about 4 inches above the lower end of the tibia seems very large and pulsates forcibly. Compression of this artery causes the bruit in front of the ankle to disappear but apparently intensifies the one below the internal malleolus. A pulse can be felt in the region of the posterior tibial vessel, the compression of which converts the bruit into a shrill musical sound. Compression of this artery and of the anterior tibial vessel causes the disappearance of all bruits. The right popliteal artery does not appear to be any larger than the left one. When the patient stands up for a long time or at evening after she has been working all day, the toes of the right foot get rather cyanotic, especially the second toe. Blood pressure 164/100, Right leg; 132/90, left leg; 130/88, right arm.

This case illustrates the great difficulty of curing long-standing cirsoid aneurysms, especially those of the hands and feet. The mass of extremely thin-walled, dilated and pulsating arteries and veins encourages the development of numerous communications. This is especially true in the old cases where the ramifications of these very abnormal vessels can be subjected to the trauma of joints. In the hands and feet the effect of the numerous joints on these vessels must produce fistulae

very easily. Even after the excision of all abnormal communications, it is entirely likely that new ones could easily be produced by the trauma of the joints upon the degenerated vessels that

FIG. 14. Six months after the application of a markedly constricting band to a dog's aorta. The band has cut through, establishing a new lumen behind it.

were left. In the case reported, it seems that the communications in the foot proper have been eliminated but that new ones have occurred in the vessels about the astragalus. A direct attack on these communications will be difficult and, before doing this, further ligations of the dilated proximal arteries will be done. The enormous blood supply to the foot makes it apparently safe to ligate any number of large proximal arteries. Although we have already ligated the anterior tibial, the dorsalis pedis and the posterior tibial arteries, I believe the popliteal could also be ligated without danger of gangrene.

CASE IX. A small white boy, aged eight years, was admitted to the Children's Hospital, March 12, 1928, with an eye condition for which he had previously consulted Dr. D. T. Vail, Jr. In June 1927, or eight months previously, the child had injured his left eye by running a small piece of chicken wire into the eye ball. This puncture was apparently into the lower inner quadrant of the eye, although no scar of it could be detected. Six weeks after this injury the eye became reddish and he was treated for pink eye. By September the left eyelids, particularly the upper lid, were

noted to be swollen, and the conjunctival veins were very large and very red. Later the supraorbital vein became large and varicosities appeared in the eyelids and on the nose around the inner canthus of the eye. When he

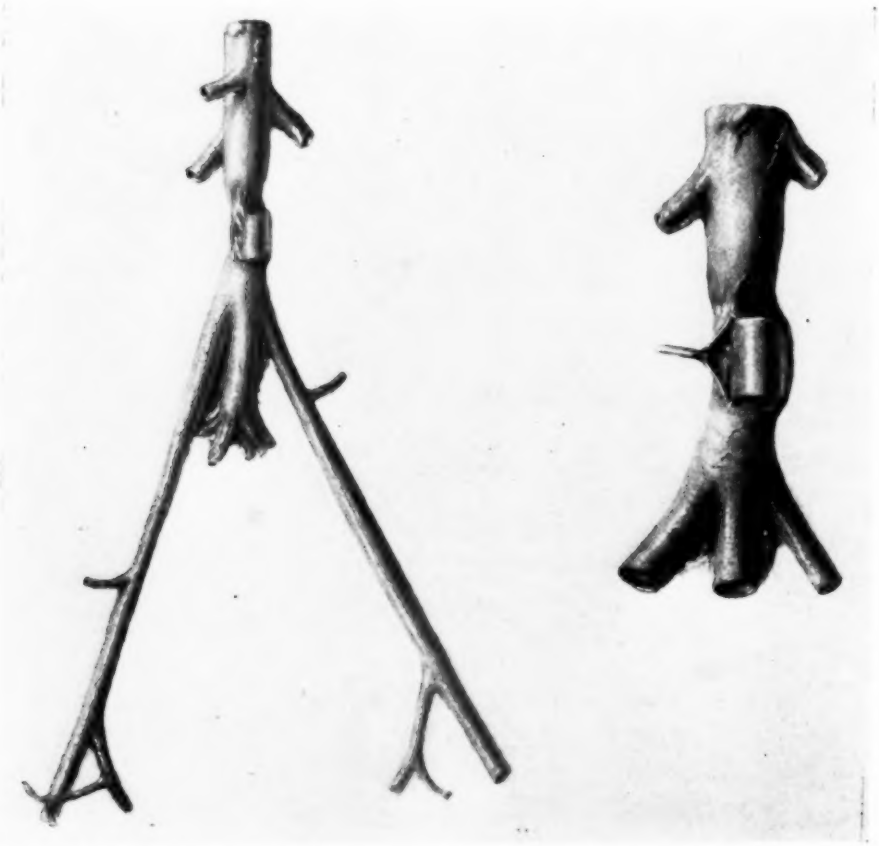


FIG. 15. Four months after the application of a band, tightened to the point of almost complete occlusion. The dog's aorta was completely occluded at the time of sacrificing him, but note that the band is practically extended from its original site.

was first seen by Dr. Vail, a few days before our operation, an aneurysm of the eye was detected. The conjunctival veins were very large and distended with arterial blood. They, as well as the larger varicosities of the eyelids, nose and forehead definitely pulsated. The eyeball protruded to a moderate degree and definitely pulsated. There was no edema such as is usually very marked when there is an intracranial arteriovenous fistula between the cavernous sinus and internal carotid artery. The retinal veins were distended and pulsated. Vision did not appear to be disturbed. On light palpation over the closed eye a faint thrill could be felt. A definite arterio-

venous bruit could be heard over the eye, nose and forehead. Temporary occlusion of the common carotid artery caused the eye to recede, the veins to collapse partially and to cease pulsating, the thrill and bruit to disappear. Not knowing exactly where the perforation had occurred and because the most marked signs of cirsoid aneurysm were at the inner angle of the eye, I felt that the abnormal communiactions were probably between branches of the external carotid artery and the neighboring veins.

Operation, March 13, 1928. We first exposed the bifurcation of the common carotid artery. Here we were surprised to find that temporary occlusion of the external carotid artery had no effect on the aneurysm but that occlusion of the internal carotid completely stilled it. Consequently, the external carotid artery was permanently ligated with a heavy silk ligature and the common carotid was occluded by a removable aluminum band. Through a Kilian incision over the left tear sac and extending into the brow, the supraorbital and other large veins in the exposed area were excised. Another small incision in the upper eyelid allowed the removal of a large vein. All ligations were made with silk ligatures.

For five days after the operation, the patient vomited very frequently. On the third day a slight weakness of the right face and of the right arm was noted. This paralysis did not progress but disappeared entirely in about two weeks. We interpreted the vomiting, as well as the paralysis, as being due to cerebral anemia. During this period of uneasiness, it was a great comfort to know that we could remove the metallic band if the symptoms demanded it.

The patient has made a complete recovery and now shows no evidences of an aneurysm or of any cerebral disturbances. In this case the terminal branches of the ophthalmic artery were certainly involved in the anastamosis. There may have been only one abnormal arteriovenous communication, but, in any event, the clinical picture was typical of a cirsoid aneurysm.

September 27, 1930. Examination of this patient reveals some interesting findings. The dilated conjunctival veins have almost completely disappeared. There is no exophthalmos. No enlarged veins in the eyelids, about the nose or on the forehead are seen. Auscultation over and about the eye reveals no bruit. There is no evidence of any right-sided weakness. Mental development appears to be normal.

In the neck, the left common carotid artery is about one-quarter as large as the right, and definitely pulsates. At the site of the occluding band, a loud harsh systolic bruit can be heard such as one can hear when an artery is markedly constricted. Four months after the original operation, the artery was totally occluded for I could not then detect either a murmur or a pulsation. Since that time and now, there has been a partial restoration of the lumen with a return of function in the artery.

This is a confirmation in the human of similar observations that Dr. Halsted and I frequently made when occluding the abdominal aorta of dogs with the metallic band. On the other hand a partially occluding band very frequently led to a complete occlusion of the vessel.

In dogs, we usually observed a dilatation of the artery distal to a partial occlusion of its lumen. As yet, no such effect is obvious in the case of this child. In the years to come we may have the chance to watch its development just as Halsted did in a remarkable case where he partially occluded the innominate artery.

EXPERIMENTAL AND CLINICAL BASIS FOR

# ARTERECTOMY IN THE TREATMENT OF LOCALIZED ARTERIAL OBLITERATIONS

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AS A RULE we consider only the mechanical interference with the circulation of blood which results from the localized arterial obliteration following ligation, arterial embolism or arteritis, since we are accustomed to regard the arteries as rubber tubes which carry the blood mechanically, and we too often forget that the arterial wall itself can influence the circulation of blood by way of its own nerves. Normally the arterial wall changes every instant and modifies the flow of blood by definite vasomotor reactions which are most marked in the arterial capillary system distal from the point of excitation. Vasomotor changes of a lesser degree also occur proximal to the point of excitation as well as generally throughout the entire vascular system. A large number of the nerves of the arteries are sensory in nature and by way of reflex action they control these peripheral vasomotor changes. Experimentally it has been shown that these nerves can be excited by changes in the chemical composition of the blood and by physical distention of the artery itself. I believe they play an important rôle in the normal and pathological physiology of the circulation of the blood. When an artery becomes obliterated these nerves do not remain intact but, on the contrary, are put into a stage of hyperexcitation by the trophic changes in the arterial wall and the organization of the blood clot which occurs at the site of the trauma or inflammation. This chronic hyperexcitation may give rise to vasomotor disturbances either of the vasoconstrictor or of the vasodilator type. I am of the impression that the cyanosis, pain, trophic disturbances, muscular hypotonia and, not infrequently, crises of the pseudo-Raynaud type that appear

after the obliteration of an artery are due to such reflex vasomotor reactions.[1] The signs and symptoms which appear after the obliteration of a large artery may be divided into two main classes: first, those due to the mechanical interference with the flow of blood causing intermittent claudication and, secondly, the cyanosis, pain, trophic disturbances and muscular hypotonia which result from the chronic excitation of the nerves in the arterial wall. The obliterated artery ceases to be an artery and becomes a diseased sympathetic nerve. The fact that these symptoms and signs disappear immediately after the resection of an obliterated artery that resulted from ligation is clinical proof that the obliterated artery acts as a diseased sympathetic nerve. The following case history is presented as a typical example of this type of disturbance.

On July 9, 1916, a soldier, wounded in battle, was admitted to the base hospital. An extensive wound of the upper arm necessitated the ligation of the brachial artery and brachial veins. The severed median nerve was sutured. The patient was again seen on November 15, because of complete loss of function of the hand. Examination showed that the motor paralysis was almost complete. The skin of the hand was cold and cyanotic. The radial pulse could not be felt on that side. The muscles of the arm could be excited by a galvanic current but not by a faradic current. A second operation was performed on November 18, 1916. The median and ulnar nerves were found to be embedded in dense scar tissue. Both nerves were carefully freed from the surrounding tissue and then each was encased in a separate facial sheath. There was no improvement following this operation. On January 8, 1917 another operation was performed in which the brachial artery was isolated. It was found to be transformed into a fibrous cord throughout its entire length. A segment of the artery 12 cm. long was resected. The nerves were left undisturbed. The following morning the hand was very warm and the cyanosis had completely disappeared. The radial pulse was palpable but it was very feeble. The pain had completely disappeared and the patient was able to flex his fingers to approximately 90 degrees. There was a marked improvement: in the general circulation of the hand and forearm as shown by the following comparative measurements:

A. Readings made before the second operation (neurolysis), Nov. 18, 1916.

| | Normal side | Injured side |
|---|---|---|
| Systolic blood pressure | 130 mm. | 0 mm. |
| Oscillometric index (Pachon) | 2 | 0 |

B. Readings made one week after the neurolysis, Nov. 25, 1916.

| | Normal side | Injured side |
|---|---|---|
| Systolic blood pressure | 135 mm. | 0 |
| Oscillometric index (Pachon) | 2 | 0 |
| Arteriolar pressure (Gaertner) | 120 mm. | 100 mm. |

C. Readings made one day after the arterectomy, Jan. 9, 1917.

| | Normal side | Injured side |
|---|---|---|
| Systolic blood pressure | 100 mm. | 65 mm. |

D. Readings made five days after the arterectomy, Jan. 13, 1917.

| | Normal side | Injured side |
|---|---|---|
| Systolic blood pressure | 110 mm. | 115 mm. |
| Oscillometric index (Pachon) | 2 | 1 |
| Arteriolar pressure (Gaertner) | 120 mm. | 120 mm. |

E. Readings made thirty-five days after the arterectomy, Feb. 13, 1917.

| | Normal side | Injured side |
|---|---|---|
| Systolic blood pressure | 130 mm. | 65 mm. |
| Oscillometric index (Pachon) | 3 | ½ |

The influence of arterectomy upon trophic ulcerations is equally striking and the following case has been selected as a typical example of the benefit that may be derived from this form of therapy.

A soldier, wounded in battle, was brought into the base hospital. Examination revealed a compound comminuted fracture of the lower leg and a deep, lacerated wound on the anterior aspect of the thigh. It was necessary to amputate the leg in the lower third and also ligate the superficial femoral artery. The immediate postoperative course was uneventful. The patient returned some weeks later because of trophic ulcers on the stump. The leg was re-amputated in the upper third. The wound healed by first intention but a short time later small ulcers appeared on either side of the scar. In spite of a negative history for syphilis intensive antiluetic treatment was carried out but it produced no improvement in the ulcerations.

About eighteen months after the original injury I saw the patient for the first time. Examination showed the stump to be very edematous,

hyperesthetic and the distal portion was covered with eczema. The patient complained of constant throbbing pain in the entire stump. There were two ulcerated areas about 2.5 cm. in diameter near the end of the stump. The ulcers had grayish-green moist bases and were surrounded by dense scar tissue.

On May 4, 1922, I isolated the femoral artery and found that it had been transformed into a solid fibrous cord and was embedded in dense scar tissue. A segment of the artery about 8 cm. long was resected. The wound was closed tightly. By the next morning the pain and edema had completely disappeared. The stump was very warm and the eruption on the skin of the stump was less moist. The ulcers soon became dry and a crust appeared over them. On the fourth postoperative day one of the ulcers was completely epithelialized and two days later the other ulcer was also completely healed. The patient left the hospital twelve days after the operation with both ulcers completely healed, the eczema dry, the edema of the stump completely gone and without pain.

In 1917 six similar cases were reported by Heitz and myself.[2] In all of these cases an arterial obliteration produced definite peripheral vascular disturbances that were not due to the diminished flow of blood to the extremity. Without doubt, the edema, cyanosis, pain, subjective impression of cold and the trophic ulcerations were the result of a vasomotor reflex. The removal of the obliterated artery did not modify the circulation mechanically but by reflex action caused all of these signs and symptoms to disappear. For this reason I believe arterectomy should be considered as an operation upon the nervous system since in last analysis it is a very complete arterial sympathectomy.

In 1920 Halsted[3] published the following interesting observation which strengthens the argument for the resection of an obliterated artery. On April 26, 1918 he performed a ligation of the left subclavian and axillary arteries because of a subclavian aneurysm. Following this operation the patient was greatly improved but his left hand remained cold and cyanotic. There was only a slight improvement in the circulation of the left hand and forearm during the following two years. At a second operation performed in 1920 the obliterated aneurysmal sac was excised. Halsted was greatly surprised

to find that, within six hours after the operation, the hand, which had been cold for more than two years, suddenly became very warm. Fifty-six days later the left hand and forearm were still warmer than the right. This is the same type of hyperemia that I have observed after the resection of an obliterated artery. The physiological changes which occur after arterectomy are due to the resection of the sympathetic nerve fibers in the wall of the artery and consequently are identical with the changes which occur after periarterial sympathectomy. For this reason I have emphasized for many years that resection of a small part of the artery should always be substituted for simple ligation. In my clinic since we have been doing a resection of a part of the artery in place of simple ligation we have had decidedly fewer cases of vasomotor disturbances in the extremities to deal with.

In order to determine if the same physiological changes could be reproduced in an experimental animal I asked two of my assistants, Dr. Stricker and Dr. Orban[4] to carry out experiments concerning this problem. In five to nine successive stages they removed the following large arteries of the dog: the femorals, the anterior tibials, the posterior tibials, the inferior gluteals, the external iliacs, the hypogastrics, the brachials, the radials and the lateral sacral arteries (Fig. 1). At the final operation of each series the bifurcation of the aorta and the common iliac arteries were removed. The carotid arteries, the thoracic aorta and the abdominal aorta down to the origin of the inferior mesenteric artery were not removed.

Within a few hours after each operation the corresponding extremity became colder than the opposite member, but only rarely was there any visible edema of the extremity. After about thirty hours the extremity became warmer than the opposite side and as soon as this hyperemia was established the function of the extremity returned completely and the animal was able to walk about normally. This return of function did not always occur, however, after simple ligation of the artery. These dogs had practically no large arteries of the

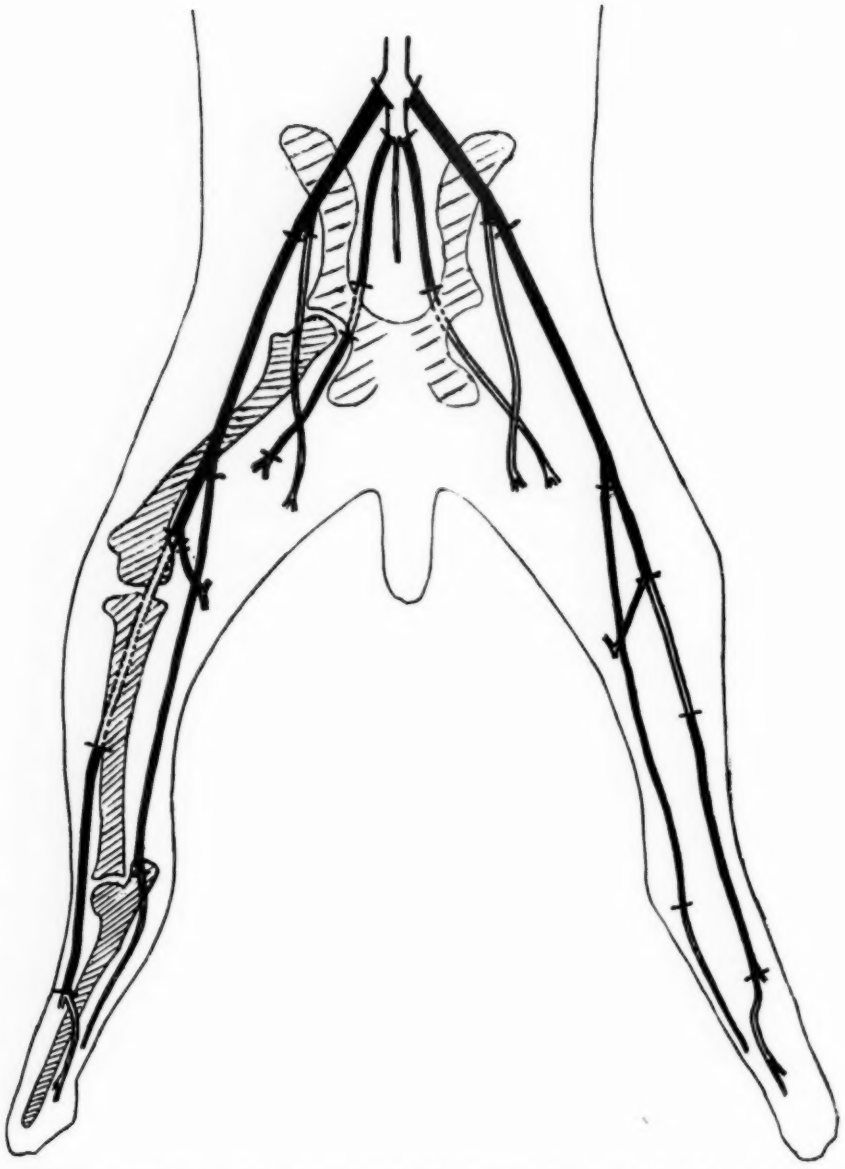

FIG. 1. Diagram of the main arteries of the hindlegs of Dog 284, showing, in black, the segments that were resected at the following operations:

| | |
|---|---|
| Sept. 11, 1929 | Right common iliac artery |
| Oct. 21, 1929 | Left common iliac artery |
| | Left hypogastric artery |
| | Right hypogastric artery |
| Nov. 14, 1929 | Right femoral artery |
| | Left femoral artery |
| Jan. 27, 1930 | Right anterior tibial artery |
| | Left anterior tibial artery |
| | Right posterior tibial artery |
| | Left posterior tibial artery |
| Feb. 17, 1930 | Right inferior gluteal artery |

Following these operations the animal showed no evidence of trophic disturbances in the extremities. The animal was able to run and jump as well as a normal dog. On Feb. 2, 1930 she gave birth to four well-developed pups.

limbs yet within a week after the last operation of the series they were able to run around, stand on their hind legs and jump over obstacles with the same facility as normal dogs.

In another series of dogs we studied the comparative effect of ligation and resection of an artery. The artery was simply ligated on one side, while on the opposite side of the animal the corresponding artery was resected. Invariably the collateral circulation was completely established after approximately thirty hours on the side where the artery was resected while two to three days were required for the establishment of the collateral circulation on the side where the artery was ligated. In many of the dogs the collateral arterial circulation was studied by means of the *x*-ray after the injection of an opaque material into the entire arterial system (Fig. 2). In the animals in which the arteries were resected we were not able to demonstrate the newly formed network of collateral arteries which Luigi Porta[5] called "anastomosis of collateral direct type," while after simple ligation this type of anastomosing arteries is always present. However, the collateral arteries were much more numerous after the resection of a large artery than after simple ligation of it.

Stricker and Orban[4] then attempted to make a massive resection of the main arteries at one operation, removing the bifurcation of the aorta and both common iliac arteries at one time. All of the dogs subjected to this operation died within a few days after the operation with marked edema of the legs, loss of motor function of the legs, a decided drop in the temperature of both extremities associated with marked cyanosis. However, if both lumbar sympathetic chains were removed just prior to the resection of the bifurcation of the aorta and the common iliac arteries, the grave disturbances in the extremities did not occur and the animal was only slightly disturbed by the very extensive arterectomy. Twenty-four hours after the operation the hindlegs were slightly warmer than the forelegs and within six days the animals were able to run and jump without any discomfort or impairments of function of the

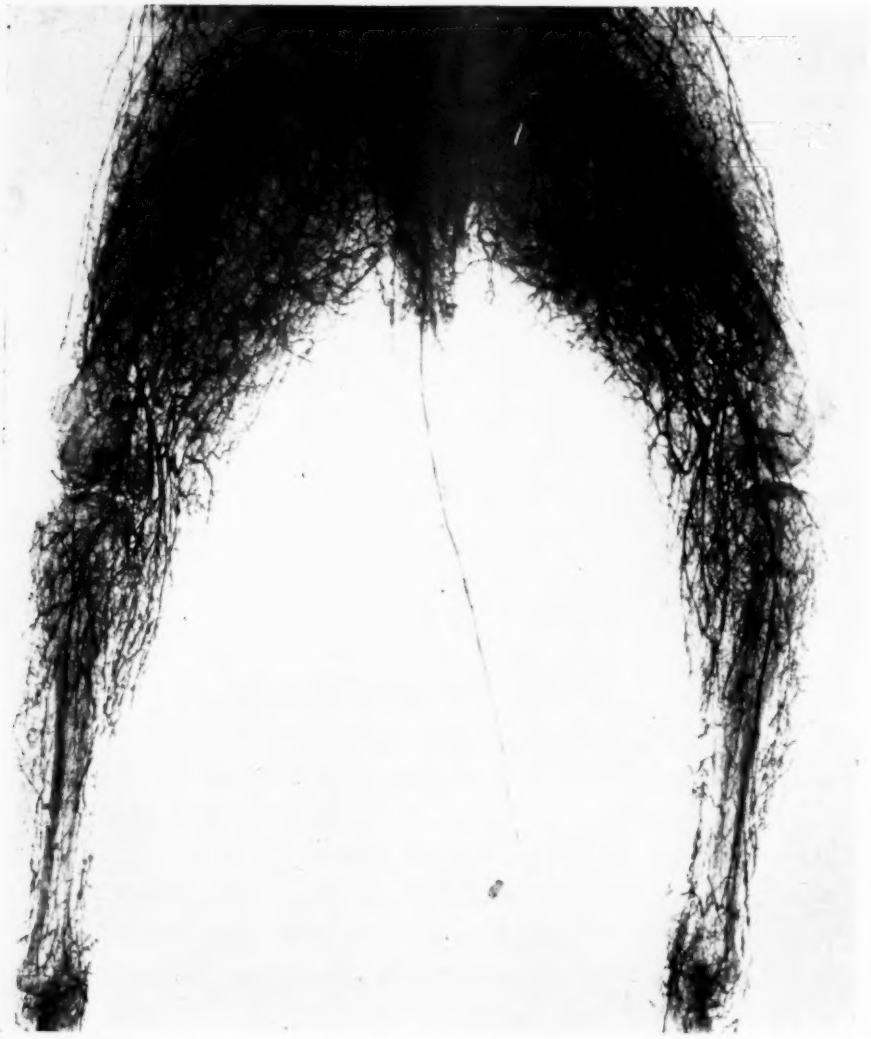

FIG. 2. Dog 265. Roentgenogram of the injected arterial system taken about eight months after all the large arteries of the extremities had been resected. Collateral arterial circulation was well established.

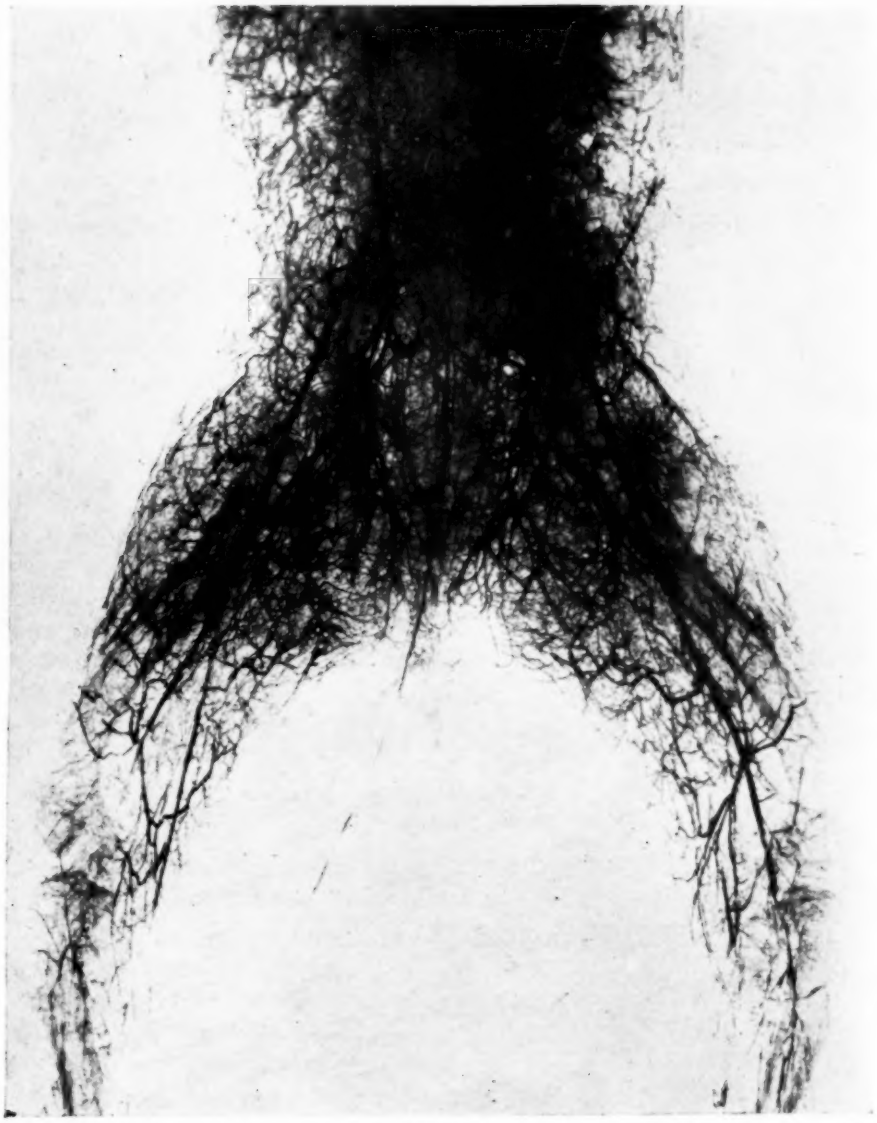

FIG. 3. Dog 347. Roentgenogram of the injected arterial system taken one month after the resection of the bifurcation of the aorta and both common iliac arteries. This extensive arterectomy was preceded by an extirpation of both lumbar sympathetic chains.

legs. No trophic ulcerations have ever appeared on any of the animals of this group, even though some of the animals were allowed to lead an active life for more than four months. The collateral arterial circulation was shown to be well established by the roentgenograms of the extremities taken after the arterial system had been filled with a liquid that was opaque to the *x*-rays (Fig. 3).

These experimental studies show the important rôle played by the lumbar sympathetic nerves and the nerves of the arteries in the regulation of the peripheral circulation. They help us to understand the part played by these nerves in the vascular disturbances that follow arterial obliteration and justify the resection of the obliterated artery in all such cases.

Since 1916 I[6] have performed many arterectomies for arterial obliteration following ligation, trauma, acute thrombosis, arteritis due to frostbite, emboli (which were too late for embolectomy), localized arteritis and recent thrombosis in arteriosclerosis. Usually there was a great improvement in the circulation following the arterectomy but occasionally the procedure failed to give even the slightest improvement. The best results were obtained in those cases in which it was technically possible to remove the entire obliterated portion of the artery leaving unobstructed artery above and below the resected area. Arterectomy is, consequently, of little value in true thromboangiitis obliterans (Buerger's disease) since the obliteration of the arteries is far to extensive to permit complete removal.

The great majority of my cases have already been published[7] but for the purpose of illustration I would like to present the following two case histories as typical examples of the beneficial results following arterectomy for localized arterial obliteration.

CASE I. A printer, aged fifty-six years, entered the hospital because of severe pain in his left arm of about three weeks' duration. He had always been in good health. No history of diabetes, heart disease or infectious diseases. He denied syphilis. Blood pressure was normal. Blood Wassermann

eaction was negative. His present illness began on September 2, 1928. While at work he felt a sudden, severe, sharp pain in his left forearm. His left hand became cold and he was unable to move his fingers. The

FIG. 4. Photograph taken several weeks after the resection of the obliterated brachial artery. Note the ability of the patient to close his fist tightly.

pain remained about the same until he immersed his arm and hand into hot water. Within a few minutes the pain disappeared and he was able to move his fingers. The subjective sensation of cold in his left hand remained unaltered by the hot water. About seventeen hours later the same phenomena recurred but this time the pain and the loss of function of the fingers was not influenced by the hot-water bath. For weeks there was no improvement, then gradually the pain in the hand and forearm became less severe and there was a partial return of motion of the fingers and wrist. There was no palpable pulsation in the brachial artery and there was an absence of oscillations by the Pachon oscillometer.

On September 25, 1928 the brachial artery was exposed at operation and found to be obliterated by a red clot which extended from the lower third of the artery through the bifurcation and into the radial and ulnar arteries. These arteries were also obliterated. Seven centimeters of the brachial artery including the bifurcation were removed. The wound healed by primary intention (Fig. 4).

Histologically the arterial lumen was completely obliterated. About four-fifths of the obliteration was due to a recent clot of fibrin while one-fifth was due to an old thickening of the intima of the artery. There was no evidence of any inflammatory reaction in the wall of the artery. Cultures of a piece of the arterial wall showed no growth of bacteria.

The next morning the left hand was very warm, the pain had disappeared completely and there was a marked improvement in the motion of all the fingers. There were slight oscillations produced in the Pachon oscillometer. The patient was discharged from the hospital nine days after the operation. Two weeks later he returned to his work as a printer. He stated that within three weeks after the operation he was unable to detect any difference between his two hands. He has been seen at regular

intervals since the operation and there has been no return of his former symptoms. In April 1930, about nineteen months after the operation, he was examined and his left hand was found to be slightly colder than the right. The strength, however, remained very good. Dynamometer tests showed a reading of 40 kilograms for each hand. Except for very fine movements of the thumb and index finger of the left hand the motion of the fingers was excellent. No pulsations could be felt in either the brachial or the radial artery of the left arm. Only very slight oscillations were produced in the Pachon oscillometer when the cuff was applied to the left arm. The arteriolar pressure as measured by the Gaertner instrument varied from 40 to 60 mm. on the left and from 100 to 110 mm. on the right side. There was no evidence of any other circulatory disturbance in the extremity.

Case II. A forty-six year old school-teacher was referred into the hospital because of vasomotor disturbances in the right arm and hand. Her present illness began in about 1911 with marked weakness of her right hand especially after slight exertion. The entire right hand and forearm became red and the superficial veins became very prominent when her arm was put in the dependent position. Gradually the condition grew worse and soon the entire arm became cyanotic on slight exposure to cold. These vasomotor disturbances were associated with severe cramp-like pains. The pains were at first limited to the right hand but later began to extend over the entire forearm and up to the shoulder. If the exposure to cold was continued the cyanosis of the hand would be replaced by a marked blanching which usually started on the fourth finger. Within the last few years the crises had become increasingly more frequent and extremely painful, and during the last few months had become so frequent at night that the patient had been unable to get any rest. On examination there was marked hypotonia and loss of strength of the muscles of the arms. During the examination the patient had one of these crises which I observed personally. It was a typical crisis of Raynaud's disease. There was also marked hyperkeratinization of the thumb nail as is frequently seen in Raynaud's disease. After the crisis all the movements of the hand and fingers were normal but the patient complained of complete loss of strength. She gave a history of intermittent claudication of both arms. She added that when she attempted to write on the blackboard in school her arm would become fatigued quickly and would fall to her side. The oscillometric index was only ¼ on the right side and seven on the left side. There was no pulsation of the subclavian artery palpable in the supraclavicular fossa. There was an old pseudo-arthrosis of the clavicle which was unknown to the patient and which probably dates back to her childhood.

On February 12, 1921 I isolated the subclavian artery and found it was completely obliterated. I resected the artery from the clavicle to a point between the scaleni muscles. Following the operation the crises disappeared and there was a general improvement in the circulation of the arm. One month after the operation she was able to write with her right hand. She, however, never gained sufficient strength in that hand to permit her to do hard work. Histological examination of the resected segment showed the lumen to be completely filled with a partially organized clot. There has been a very slow but constant improvement in the circulation of the right arm. At the present time she is very well. She has had no pain in her arm since the operation. During the winter, however, prolonged exposure to cold causes moderate cyanosis of the forearm and hand but entirely without pain.

It is interesting that in this case a typical Raynaud's syndrome was produced by a localized obliteration of the subclavian artery. These severe painful crises have completely disappeared since the resection of the obliterated subclavian artery which was done over nine years ago.

## REFERENCES

1. Leriche, R. Du syndrome sympathique consécutif à certaines oblitérations artérielles traumatiques et de son traitment par la sympathectomie périphérique. *Bull. et mém. Soc. nat. de Cbir., Paris*, 31: 309 (Jan. 31) 1917.
2. Leriche, R., and Heitz, J. De la réaction vaso-dilatatrice consécutive à la résection d'un segment artériel oblitéré. *Compt. rend. Soc. biol.*, 80: 160 (Feb. 3) 1917.
3. Halsted, W. S. A striking elevation of the temperature of the hand and forearm following the excision of a subclavian aneurysm and ligation of the left subclavian and axillary arteries. *Bull. Johns Hopkins Hosp.*, 31: 353 (July) 1920.
4. Leriche, R. Du rôle de l'innervation pariétale des artères et du sympathique dans le rétablissement de la circulation collatérale après oblitération ou ligature, d'après les recherches expérimentales de P. Stricker et F. Orban. *Bull. et mém. Soc. nat. de Cbir., Paris*, 56: 657 (May 21) 1930.
5. Porta, Luigi. Delle alterazioni patologiche delle arterie par la ligatura e la torsione. Tipographia di Giuseppe Bernardoni di gio, Milan, 1845.
6. Leriche, R. Résultats éloignés des ligatures et des résections artérielles. *Congrès Franç. de Cbir.*, 31: 260, 1922.
7. Leriche, R., and Stricker, P. Documents anatomo-cliniques de chirurgie vasculaire. *Lyon Cbir.*, 27: 137 (March–April) 1930.

# RAYNAUD'S DISEASE AND THROMBOANGIITIC GANGRENE

## OF THE UPPER EXTREMITIES TREATED BY RESECTION OF THE SYMPATHETIC GANGLIA AND TRUNK

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TREATMENT of gangrene of the limbs has recently reached greater surgical importance, owing to new diagnostic and therapeutic principles.

As Dr. Matas is one of the most prominent modern contributors to the treatment of diseases of the blood vessels and of lesions resulting from circulatory troubles, so for his Jubilee I have chosen to report the results of my personal experience in some cases of this kind of lesion.

In a consideration of embolic gangrenes one can easily realize what great progress has been accomplished in diagnosis and surgical treatment. Since the first imperfect endeavors (Ssabanejeff, 1895) what a long and difficult way to the modern early and technically perfect operations which are often followed by long-standing cures!

What we need is a more close and ready collaboration between surgeons and internists. These must be convinced that only surgery can save the limb and often the patient's life when a peripheral artery is closed by the impaction of an embolus. As an early diagnosis is not difficult, surgeons ought to be called to operate as soon as possible; so the successes will increase and I dare say that nearly every case will be cured. What can be obtained in this line is shown by the many successful cases reported especially by Scandinavian surgeons (E. Key,[1] Widerões, Lindström). Also the bold Trendelenburg operation for removal of emboli from the pulmonary artery has reached its goal (Krüger, Kirschner, Mayer, Nyström[2]).

But in these cases the pathogenesis of the gangrene is clear enough and in consequence treatment is well defined. There

are, however, other varieties of gangrene whose predisposing and exciting conditions are not well known at all. I mean those in which obstruction of blood vessels is not to be found, or this is only secondary and diffuse.

An instance of the first class of lesions, which can also in severe cases cause gangrene, is the clinical syndrome known as Raynaud's disease (1862). Its fundamental features are vasomotor troubles of spastic character, usually affecting fingers or toes, which cause paroxysmal attacks of anemia, followed by cyanosis, with numbness or anesthesia and intense pain. Superficial sloughs or gangrene of the fingers or toes may follow. These lesions are usually symmetrical, but can prevail on one side, and are more frequent in women than in men. One item of capital importance in diagnosis is the presence of pulse in the peripheral arteries (pedis, tibialis posterior, radialis, ulnaris). Investigation of capillary circulation can give important data. Brown has advised the so-called "vasomotor or vascular index." This can be obtained by bringing forth in the patient a rise of temperature by intravenous injection of proteins (for instance, typhoid vaccine) and ascertaining the difference between the rise of local cutaneous and that of buccal or blood temperature. This "index" which in arteriosclerosis is always very low (often = 0), and can reach rather high figures (2–6) in cases of thromboangiitis obliterans, is always high in typical cases of Raynaud's disease. It is understood, therefore, that, excepting in those mild cases which yield to medical treatment, an attempt has been made to use our knowledge of the inner nature of the disease to get a cure, by severing the vasomotor pathways. The first operations of this kind were, as is well known, periarterial sympathectomies, which performed for the first time by Jaboulay, were afterwards especially extended and widely applied by Leriche[3] and other surgeons. The different results caused neurologists and surgeons to interfere more centrally with the vasomotor pathways, and to sever the rami communicantes, or to resect the ganglia or the sympathetic

trunk in its lumbar or cervico-thoracic segment according to the site of the lesion.

Diez was the first (1924)[4] to operate on the lumbar and sacral ganglia in a case of Raynaud's disease, followed by Adson and Brown (1925).[5] The latter did not know anything of Diez's operation; they were led to perform such an operation, after they had noted a remarkable vasodilation following ramisectomies or ganglionectomies of the lumbar sympathetic trunk in cases of spastic paralysis. Royle had also pointed out the same thing.

But I wish to limit myself to the cervico-thoracic ganglionectomy, which is the operation that I have performed. It is well known that the removal of the cervical sympathetic trunk, with or without the lower ganglion, has been done in cases of epilepsy, exophthalmic goiter, glaucoma and more recently in cases of angina pectoris by Jonnesco[6] and others. In cases of vasomotor troubles of the upper limbs (Raynaud's disease, sclerodermia) Brüning (1923)[7] resected the lower cervical and first thoracic ganglia by an anterior route. Following Brüning's technique, Diez has also removed the middle cervical and the cervico-thoracic ganglia for thromboangiitic gangrene in two cases. Davis and Kanavel (1924),[8] in a case of Raynaud's disease of the upper limb, removed thoroughly the cervical sympathetic trunk with its three ganglia. Royle (1927)[9] and Fulton (1928)[10] reported on ramisectomies for Raynaud's disease and thromboangiitic gangrene. Later Royle with a more perfected technique (1928)[11] (section of the clavicular attachment of the sterno-cleido-mastoideus and division of the tendon of the scalenus anticus) succeeded in severing the sympathetic trunk below the cervico-thoracic ganglion.

But Kuntz before and Brown afterwards had pointed out that the second thoracic ganglion also sends fibers to the brachial plexus through the second thoracic nerve, which very often supplies fibers to the lower trunk of the brachial plexus. Working with Adson, Brown thought, following a route proposed by Henry (1924), of reaching the sympathetic from

behind, to remove in this way the cervico-thoracic and the second thoracic ganglia together with the intervening chain, so as to sever thoroughly the sympathetic fibers to the upper limb.

With this technique Adson operated on his first patient on both sides in 1928. In 1929 Adson and Brown reported on two other cases.[12] I will not deal with the technique as it is reported with ample detail in Adson's papers. I have somewhat modified it in my cases, because I have resected not only the transverse apophysis of the second, but also that of the first thoracic vertebra. I do not think that this complicates the operation or makes it more severe, instead it makes easier the removal of the stellate ganglion, the division of its several rami communicantes and of the sympathetic trunk above.

The first patient I operated on, with the technique I have spoken of, was a case of thromboangiitic gangrene and the operation was performed on both sides.

In Raynaud's disease and, generally speaking, in all vasomotor troubles of the limbs (Weir-Mitchell's erythromelalgia, sclerodermia and so on) such operations seem fully justified by what we think the nature of the disease. In thromboangiitis obliterans this could not seem to be the case. Really we are very far from having clear ideas on the so-called juvenile gangrene. The cases which Winiwarter[14] reported in 1879 of primary non-syphilitic, non-arteriosclerotic lesions of the vessel walls have been variously explained. Those reported by Leo Bürger[15] although not clearly understood in their pathogenesis doubtless belong to the same type of disease. They occurred nearly always in men; they caused at last diffuse vasal obstruction, this feature making them quite different from those of Raynaud's disease, with simply spastic closure of arteries, but in some cases they showed symptoms very similar to those of this disease. This is so true, that several cases reported as Raynaud's disease turned out afterwards, on a more close examination, to be really typical thromboangiitic gangrene. Allen and Brown

think that the greater number of cases of so-called Raynaud's disease in men are more probably cases of L. Bürger's gangrene.

We may state that the anatomical features of this type of gangrene are well defined. I have had occasion of studying several cases of it, specimens for microscopical examination having sometimes been taken from superficial veins, and I have always found the lesions described by L. Bürger. But of their inner nature and pathogenesis, our ideas are far from being clear and certain. It is quite natural, that the leading principles of a proper treatment should also be uncertain. Bürger holds the disease as due to widespread inflammation of the vessels of a limb. The inflammation would be caused by an infective process favored by toxic and discrasic factors. An early diagnosis would therefore be necessary in an endeavor for a successful treatment, to avoid a widespread thrombosis. But this is not possible as we lack the proper treatment, and above all because generally we see patients in advanced degrees of progress of disease, complaining of actual gangrene. Thrombosed vessels can, though slowly, be made pervious again by organization and vascularization of thrombi. We can therefore endeavor to stop the progress of the disease by favoring the circulatory conditions of the limb, removing any spastic vasomotor stimulus which can be present, and we know they are present, and bringing forth a vasodilation. Sometimes these measures are able to reestablish a supply of blood sufficient for the life of the tissues.

Oppel on the contrary, and others, believe that the disease is brought forth by spastic contraction of the arteries, supported by a condition of hyperadrenalinemia. On this basis Oppel and other Russian surgeons, Leriche in France, and Donati, Serafini, Pieri in Italy, have removed the left suprarenal body to counteract that supposed predisposing condition of the disease.

We must recognize that these theories have never been proved, and really many authors do not agree with them. We must acknowledge also that the reported operated cases do not appear as striking successes.

In a previous series of seven cases of thromboangiitis obliterans, reported by my assistant Dr. Ghiron, in which I performed a periarterial sympathectomy, I have not had a single cure.

I have no personal experience with ligature of veins, or with arteriovenous anastomosis, or with operations upon the nerves of the limb, or with removal of the left suprarenal body. Anyway from the cases reported by other surgeons I think it right to infer, that in no instance has such an operation led to a permanent cure. Pains have subsided, perhaps the circulation of the limb has improved, but only for a short while.

For these reasons I did not choose any one of the aforesaid operations in an especially severe case, which I reported[18] before the Royal Academy of Medicine of Rome in March 1930. This man had undergone an amputation of both lower limbs, and complained of pains in both upper limbs, where limited, but obvious patches of gangrene were to be seen on the right side. I performed a cervico-thoracic ganglionectomy at first on this side and afterwards also on the left. As I have already pointed out, I believe this kind of operation to be especially useful when lesions are still in an early stage, it puts an end to pain and spasm and improves the circulation in the vessels which still keep an open lumen. A sufficient supply of blood to the peripheral structures is so reestablished, so that if other vessel fields are obstructed by the thromboangiitic process, the organization and vascularization of the thrombosed vessels can take a part in settling a sufficient circulatory balance, to support the vital processes of tissues.

The following are the clinical histories of my two cases:

CASE I. M. G. aged thirty-five years, from Terni.

*Previous History:* Irrelevant, denies any venereal infection and syphilis. No use of alcohol or tobacco. Married; his wife has had seven sons, of whom one died when four years old, and no miscarriages.

*Present Illness:* Fifteen years ago while in the trenches as a soldier in war time, he began to complain of pains, cramps and numbness in both his feet and legs. He considered these troubles as due to the cold weather and noticed that they increased with exercise. Dismissed from the army he

resumed his work, but his troubles persisted with short periods of well being.

Four years ago he noticed a small ulcer on his right great toe, which gradually enlarged. Admitted to the Hospital of Terni he underwent an amputation of the great toe. The wound did not heal and the gangrenous process spread to the foot and reached the leg, so that an amputation of the thigh on its middle third was performed.

During this time he had noticed that both his upper limbs, but especially the right one, easily became ischemic if exposed to cold. He was discharged as cured from the hospital and did well till April 1928. At this time he was operated on for what the patient calls an ingrowing toenail: the operation was followed by a gangrenous process spreading to the foot and accompanied by continuous pains. In this condition he was admitted for the first time to my Clinic, April 22, 1928.

*Physical examination* showed: feeble pulse on the femoral artery, on the stump of the right thigh. On the left foot the loss of the great toe and a deep ulcer on its stump was to be seen. The bottom was formed by the head of the first metatarsal bone, covered by necrotic tissues. The lesion and neighboring skin were very painful. A very painful fissure was present on the sole of the foot.

Loss of pulse on the dorsalis pedis and popliteal artery, very feeble on the femoral artery in Scarpa's triangle. Wasting of the whole limb, whose skin was dry and cold.

*Clinical Diagnosis:* Thromboangiitis obliterans.

*Operation:* June 12, 1928. Amputation of the left leg at its middle third. The wound healed per primam and pain subsided.

*Histologic examination* of the vessels of the removed limb showed inflammatory changes of the vessel walls, typical of a thromboangiitic process.

*Course:* The patient was discharged on July. With an artificial limb and a crutch he was able to go around.

After a short while he began to complain of cramps and pains in his right hand. At the same time he suffered with a phlebitis of the superficial veins of his two stumps and of right forearm. The acute process subsided and the veins were changed into hard, non-painful cords.

Five months ago, a superficial bruise left behind an ulcer above the metacarpo-phalangeal joint of the right middle finger. The lesion was very painful and so were the arm and forearm.

Admitted again to the Clinic: November 16, 1929.

*Physical Examination:* A feeble pulse could be felt on both femoral arteries in Scarpa's triangle. Stumps were in good condition. There was wasting of the right upper limb. The aforesaid ulcer with a necrotic bottom did not reach the bone. There were edema of the whole hand; cyanosis of

the tips of the fingers. The skin felt very cold. Movements were greatly hindered by pain. Sensibility was preserved. There was loss of pulse on the radial and humeral arteries of the right side and of the radial on the left, weak pulse on the left humeral artery.

*Oscillometry* (Pachon). Only the left humeral artery gives small oscillations, 3 mm. wide. Mx = 95. Mn. cannot be measured.

*Capillaroscopy*. Right side: very few, partially empty capillaries.

Left side: capillaries in somewhat greater number, very pale.

A piece of the right cephalic vein was excised. The vein looked like a fibrous cord with a very narrow lumen. On microscopic examination the walls appeared very thickened owing to the presence of connective tissue and leucocytes in the tunica media and adventitia. No thrombosis.

While in the Clinic a complete paralysis of the left musculospiral and ulnar nerves supervened. The ulcer on the right hand deepened to the bone and patches of dry gangrene appeared also on the left hand.

*Operation:* January 21, 1930. Ether. Prof. Alessandri.

Skin incision from the spinous process of the fourth cervical vertebra to that of the eighth dorsal, somewhat to the right side of the median line. After the muscles had been retracted, the right side of the spinous process, the laminae, the transverse process and the first portion of the ribs from the first to the fourth rib were exposed from the first to the fourth dorsal vertebra. The transverse process of the second dorsal vertebra is cut through with a chisel and the loosened bone is separated from the corresponding rib. The pleura was then loosened with the finger from the thoracic fascia, and the rib was severed just outside of its articular surface for the transverse process, and the loosened fragment removed. The second thoracic ganglion, its rami communicantes and the intercostal vessels and nerve of the first space were at once exposed. The sympathetic trunk was severed below the ganglion and the rami communicantes were cut through. The transverse process of the first dorsal vertebra and the first rib were resected as the second; in this way the cervico-thoracic ganglion and a piece of the cervical thoracic trunk could be removed together with the second thoracic ganglion and the intervening trunk.

*Postoperative Course:* The wound healed uneventfully.

In the days following, the patient presented a Bernard-Hörner's syndrome, loss of pain and the whole upper limb was warmer than before and also than the left one. Around the gangrenous patches an area of inflammation was now to be seen.

Capillaroscopy showed no differences. In a fortnight a weak pulse on the right radial artery could be felt and a line of separation between the living and dead tissues was clearly established. After six weeks the necrotic parts had dropped off and left behind a healthy granulating zone.

At this time a dry gangrene of the left middle, ring and little finger appeared. The hand was swollen, cyanotic and painful.

*Operation:* April 4, 1930. (M.A.S.S. and local anesthesia). Prof. Allessandri. Removal of the left cervico-thoracic and first thoracic ganglia with the technique outlined previously.

*Postoperative Course:* The patient suffered a postoperative bronchopneumonia which subsided in one week. A Bernard-Hörner's syndrome appeared also on the left side. The limb was much warmer than before. Pains and edema disappeared. The gangrenous parts separated and dropped off. In such fairly good condition the patient was discharged from the Clinic.

I saw him again on July 30, 1930.

He complained of no more pain or circulatory trouble in his upper limbs. The finger stumps are now covered with well-nourished skin. The pulse could be felt on both humeral arteries; it could not be felt on the radial arteries.

Oscillometry: Left arm: Mx = 120 (2 mm.), Mn = 80 (5 mm.).
Right arm: Mx = 110 (2 mm.), Mn = 45 (1 mm.).

No movements on the forearms.

Case II. B. E., housewife from Rome, aged thirty-five years.

*Previous History:* Irrelevant. Married when twenty-seven years old, has had one son. No miscarriages. Has always complained of cold extremities in winter time. Two years ago noticed that both hands became extremely pale and soon afterwards of a bluish hue when exposed to cold, and were numb and painful. Lately necrotic patches had appeared on her finger tips, which had dropped off and left behind a granulating zone. Admitted to the Clinic: April 28, 1930.

*Physical Examination:* both index, middle and ring finger showed a cyanotic color with pale spots. Stellate scars are to be seen on the tip of the left middle and right middle and ring fingers. On the right index finger there was a whitlow covered with thickened skin.

When cooled with ether the cyanotic color spread to the whole hand, when warmed with a hot-water bag cyanosis changed into a pale color. The skin felt cold and damp.

Arterial pressure: left humeral artery: 110–70.
right humeral artery: 110–65.
right forearm: 90–80.
left forearm: 90–80.

Oscillations are wider on the left side. Increase of venous pressure on both sides.

Capillaroscopy shows the typical changes of vasoneurosis.

Basal metabolism: 25 per cent.

Suprarenin rate in blood: inferior to normal.

*Operation:* Prof. Alessandri, May 29, 1930.

Ether. Skin incision one inch to the left of the median line, from the spinous process of the fourth cervical vertebra to that of the fifth dorsal. Resection of the left transverse process of the first and second dorsal vertebrae and of one inch of the corresponding ribs. Removal of the second thoracic and cervico-thoracic ganglia; rami communicantes and sympathetic trunk above and below severed. The second intercostal artery tied and the second intercostal nerve cut through. A small opening of the pleura was easily closed.

*Postoperative Course:* As soon as the operation was completed a Bernard-Hörner's syndrome appeared. Both hands were warmer and of normal color, but the left one was distinctly warmer.

Pressure on left forearm: 140–80, wide oscillations.

Pressure on right forearm: 90–70.

After a couple of days the temperature of the skin of the hands fell to normal. Oscillations on the left forearm were less wide.

After one week oscillations were as before the operation, but temperature was normal and the pains had disappeared.

The patient was discharged one month after the operation in good condition, complaining of no trouble whatsoever.

## REFERENCES


1. Key, E. *Acta Chir. Scandinav.*, 1922.
2. Nyström, G. Weitere Erfahrungen mit der Trendelenburgsche Operation. *Arch. f. klin. Chir.*, 157: 35, 1929.
3. Lériche, R. De l'élongation et de la séction des nerfs périvasculaires dans certaines syndromes douloureuses d'origine artérielle et dans quelques troubles trophiques. *Lyon chir.*, 1913; see also: *Presse méd.*, 25: 513, 1919.
4. Diez, J. El tratamiento de las affeciones troficas y gangrenosas de los miembros por la resecion de las casenas cérvico-toracica y lumbo-sacral del simpatico. *Prensa med. Argent.* 12: 11 Sett., 377, 1925–26.
5. Adson, A. W., and Brown, G. E. Treatment of Raynaud's disease by lumbar ramisection and ganglionectomy and perivascular sympathetic neurectomy of the common iliacs. *J. A. M. A.*, 84: 1208, 1925.
6. Jonnesco, T. Traitement chirurgical de l'angine de poitrine par la resection du sympathique cervico-thoracique. *Presse méd.*, 1: 193, 1921.
7. Brüning, F. Weitere Erfahrungen über den Sympathicus. *Klin. Wchnschr.*, 2: 1872, 1923.
8. Davis, L., and Kanavel, A. B. Sympathectomy in Raynaud's disease, erythromelalgia and other vascular diseases of the extremities. *Surg. Gynec. Obst.*, 42: 729, 1926.

9. Royle, N. D. The surgical treatment of Raynaud's disease and similar conditions. *Med. J. Australia*, 11: 341, 1929. Suppl.

10. Fulton, J. F. Vasomotor and reflex sequelae of unilateral cervical and lumbar ramisectomies in a case of Raynaud's disease, with observations on tonus. *Ann. Surg.*, 88: 825, 1928.

11. Royle, N. D. Sympathetic trunk section; a new operation for Raynaud's disease and spastic paralysis of the upper limb. *Med. J. Australia*, 2: 1, 1928.

12. Adson, A. W., and Brown, G. E. Raynaud' disease of the upper extremities: successful treatment by resection of the sympthetic cervico-thoracic and second thoracic ganglions and the intervening trunk. *J. A. M. A.*, 92: 444, 1929.

Brown, G. E., and Adson, A. W. Physiological effects of thoracic and of lumbar sympathetic ganglionectomy or section of the trunk. *Arch. Neurol. & Psych.*, 22: 322, 1929.

13. Brown, G. E., and Adson, A. W. The treatment of Raynaud's disease by resection of the upper thoracic and lumbar sympathetic ganglions and trunks. *Surg. Gynec. Obst.*, 48: 1, 1929.

14. Winiwarter, F. Ueber eine eigenthümliche Form von Endoarteritis und Endophlebitis mit Gangrän des Fusses. *Arch. f. klin. Chir.*, 23: 202, 1879.

15. Bürger, L. Thrombo-angiitis obliterans; a study of the vascular lesions leading to presenile spontaneous gangrene. *Am. J. M. Sc.*, 136: 567, 1908.

16. Allen, E. V., and Brown, G. E. Erroneous diagnosis of Raynaud's disease in obliterative vascular disease. Thrombo-angiitis obliterans. I: Vasomotor disturbances simulating Raynaud's disease. *Am. J. M. Sc.*, 174: 319, 1927.

17. Ghiron, V. La tromboangioite obliterante. Studio clinico e sperimentale. *Arch. ital. di chir.*, 23: 227, 1929.

18. Alessandri, R. Asportazione bilaterale del terzo ganglio simpatico cervicale e dei primi due toracici in un malato affetto da tromboangioite obliterante, già amputato degli arti inferiori. *Boll. & Atti R. Acc. Med. di Roma*, 16: 144, 1930.

# PERSONAL EXPERIENCE IN VASCULAR SURGERY

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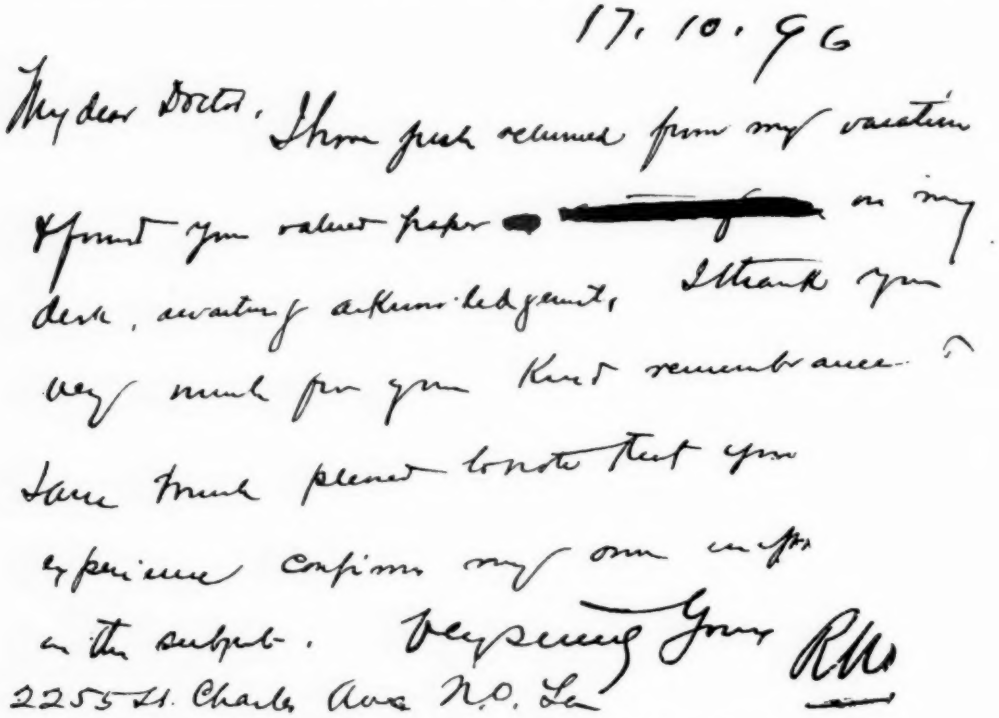
RALEIGH, N. C.

THIRTY-FOUR years ago a young man just entering upon the practice of medicine reported the results of some observations which had interested him at the end of his first year's work. A reprint of the paper containing this report was sent by the young man to a surgeon eleven years his senior, already established in practice, and even then known as an advanced thinker and original investigator in medical subjects. Shortly afterwards (October 17, 1896) from the elder to the younger came a postcard on which was written in his fine characteristic chirography: "I have just returned from my vacation and found your valued paper . . . on my desk, awaiting acknowledgment. I thank you very much for your kind remembrance and I am much pleased to note that your experience confirms my own impressions on the subject." (Fig. 1.) Imagine, if you can, the joy implanted in the heart of the younger man who received and still cherishes this missive, and estimate, if you will, the depths of ambition stirred in him by this personal attention from the elder man, whose example and precept have furnished everlasting inspiration. From this auspicious beginning of an acquaintance by correspondence through its continuance in many delightful friendly meetings up to the present occasion when the elder man is to be honored in this volume and the younger man is permitted to pay his tribute, there has been no wavering of friendship, no fading of admiration on the part of the junior toward the senior, who cemented the bond by his gracious act of 1896. Need it be said that the elder and leading character in this narrative is none other than Rudolph Matas, master surgeon, and that the younger and grateful participant is the writer of this article?

My experience in surgery of the blood vessels has not been large, but it has extended over a period which included the older procedures, the newer conceptions and the ever-advanc-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My dear Doctor. Have just returned from my vacation & found your valued paper [redacted] on my desk, awaiting acknowledgment. I thank you very much for your kind remembrance & have much pleasure in stating that your experience confirms my own in regard to the subject. Yours Respectfully R. Matas

2255 St. Charles Ave N.O. La

FIG. 1. Facsimile of postcard received from Rudolph Matas, October 17, 1896.

ing changes still in order. With particular exceptions this experience has been limited to the treatment of aneurysms. In the early years by the older methods of ligation, I performed six operations: one each on the external and the common carotids, two for femoral and two for popliteal aneurysms. The carotid cases were cured; one femoral relapsed, the patient dying later of another disease; in one of the popliteal cases (a Hunterian ligation) there occurred a sloughing of the skin in the thigh, which continued for two months after the operation, but finally cleared up with proper healing. The second ligation in Hunter's canal effected a permanent recovery. Later on an enormous popliteal aneurysm, in which no ligation was attempted, required amputation in the lower third of the

thigh on account of an already septic sac with necrosis of the femur and infection of the knee-joint. This patient had a fatal stroke of apoplexy seven months after operation. Still another primary amputation had to be done for a large popliteal aneurysm into which a trocar previously had been plunged, producing hemorrhage and infection.

The result of the ligations in these six cases on the whole were as satisfactory as the reports of other surgeons at that time by the prevailing methods. The last of these operations was performed in 1905. All during this period every surgeon called upon to treat patients with aneurysm recognized the need for improved methods and longed for better results. Always there was fear of failure to cure, of gangrene, of recurrence, of complicating factors.

Not until Rudolph Matas devised his procedure of endoaneurysmorrhaphy did the light of day begin to shine in this wide field. To him belongs the whole credit for conceiving, proposing and executing the most successful treatment for aneurysm so far known. He hit upon the plan in 1888 and first published it in the *Transactions of the American Surgical Association* for 1902.

The older methods had been considered good enough until they were superseded in 1785 by John Hunter's ligation at a distance from the sac. In like manner one hundred years later Hunter's method was cast in the background by that of Matas. In each instance there is an illustration of the trite situation that, when an easy way has been marked out of a difficulty, the question always arises: Why did not some one think of it before?

Though the Hunterian plan in its time was far superior to ligation near the sac proposed by Anel seventy-five years before, and, though it had the vogue of a century, it possesses certain disadvantages which had been evident long before its followers admitted them. Chief among these disadvantages is the danger of gangrene. Other objections are the high percentage of relapses and persistent enlargement of the sac.

Hunter desired to tie the artery far away from the aneurysm because of the fear of degenerative changes in the arterial coats near the sac and of the risk of infecting the sac while

FIG. 2 T. F. Three days before operation. Lateral view.

working close to it. Precautions of this sort are, of course, groundless in the present day of aseptic surgery. The Anel method of ligating on the proximal side as near as possible to the sac is to be preferred to any other method of ligation (Matas).

It would be out of place in this volume to refer to the steps by which Professor Matas arrived at his epochal contribution, or to attempt any description of the technique now so widely known over the whole surgical world. I do wish, however, to put upon record here some notes of the very first operation by the Matas method I ever performed:

CASE I. James P., aged thirty-eight, butcher. Syphilis twenty years before. In April, 1912, he noticed a swelling back of his left knee. It had been getting gradually larger; he could not attend to his work. Examination showed a pulsating mass in the left popliteal space, with signs so definite as to leave no doubt of the diagnosis. The swelling was 4 inches in its longest diameter. The operation was performed August 5, 1912. With the patient lying face downward, a tourniquet was placed around the thigh at the apex of Scarpa's triangle and a liberal incision made over the middle of the aneurysm in the long axis of the leg. After exposing and opening the sac and removing the clots, the main openings of the vessel above and below were closed with one row of interrupted chromic gut sutures, then another row of continuous sutures of the same material was used, going all down the length of the sac, and finally a third row on top of these until the walls were quite approximated. By the sutures the several small openings in the sac wall were closed. The edges were brought together with silkworm gut stitches, each one taking bites in the sac so as to fold it upon itself and against the skin. In spite of great care the popliteal nerve must have been injured, for the patient had "drop foot" for several weeks after the operation. This complication, however, soon disappeared, and finally there was no evidence of the disability. The subsequent course of the patient's recovery was without interruption. He remains well to the present day.

The second operation by the same method was done a little over a year later. The report follows:

CASE II. Theodore F., forty years of age, carpenter. The patient had gonorrhea at seventeen and syphilis at twenty-two. Every spring he had rheumatism. About four years ago he first found a small knot in the left popliteal space. This continued to grow larger, becoming more painful as the size increased. For twelve months before admission to the hospital he was not able to work, and was barely able to walk on account of marked flexion at the knee joint. The swelling in this case was exceedingly large, 18 inches in circumference, and was indistinctly fluctuating, but there was absolutely no sign of pulsation. The knee joint was distended with fluid and the patella floated. The condition might easily be confused with a popliteal bursitis. This diagnosis, in fact, was originally considered. The accompanying photograph (Fig. 2) gives a fair idea of the appearance. The operation was done on December 6, 1913, in the same fashion as in the previous case. There were only two orifices in the aneurysmal cavity, the main openings of the artery. These were close together and near the surface, so that I inadvertently cut through the lower one of them when I incised the sac. But it was easily sutured and the operation

proceeded as usual according to the obliterative technique. This patient was discharged in good condition, with a healed wound and almost perfect extension of the leg. He had some numbness of the foot for ten days follow-

FIG. 3. T. F. Two months after operation. Lateral view.

ing the operation, but it gradually decreased and the circulation was always adequate. Photographs (Figs. 3 and 4) taken two months after operation indicate the improvement.

The earlier case was included by Doctor Matas in his paper read before the International Congress of Medicine at London, August, 1913. They were both published by me.[1]

Two unusual cases very recently published[2] represent my further experience with the Matas method. These will not be reviewed here, but merely noted by title and illustrations.

[1] *Old Dominion J. Med. & Surg.*, 18: 4 (April) 1914.

[2] *Surg. Clin. North America*, 10: Number 4 (August) 1930.

They were: 1. Aneurysm of the Brachial Artery; Reconstructive Endoaneurysmorrhaphy (Figs. 5 and 6). 2. Huge Aneurysm of the Sciatic Artery Resembling a Sarcoma of the Buttock

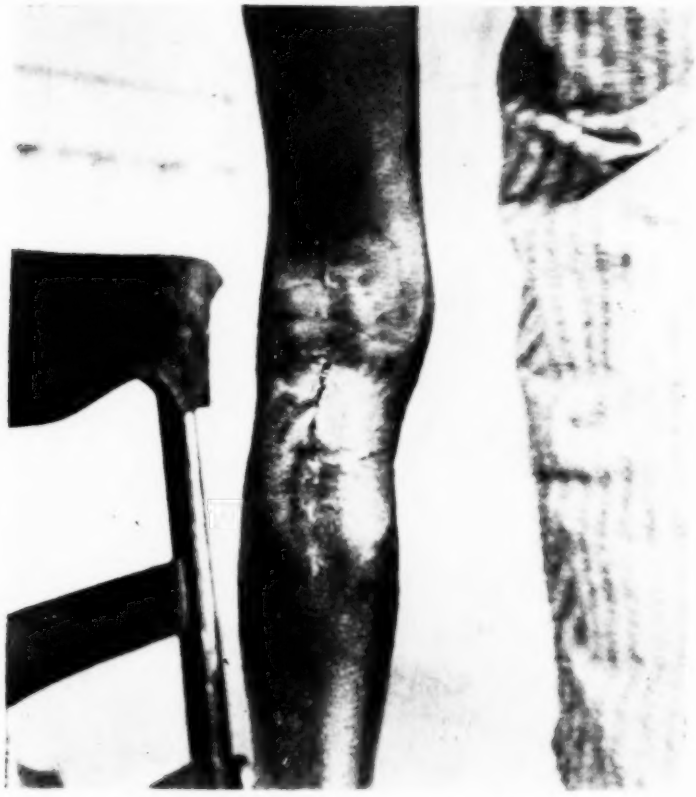


FIG. 4. T. F. Two months after operation. Posterior view.

(Figs. 7 and 8). They were treated by suturing the open mouths of the vessels at their exit from the great sciatic foramen.

Thus is exhibited the successful management at the hands of the average surgeon of a malady otherwise fatal in its ending, the treatment of which under the old methods was, to say the least, unsatisfactory. Thus is manifested the solution of a profound surgical problem by one man, who had the vision to determine the questions at issue and the genius to carry them on to pract cal performance. I do not hesitate to affirm (and it is no doubt the unanimous belief of all operating surgeons)

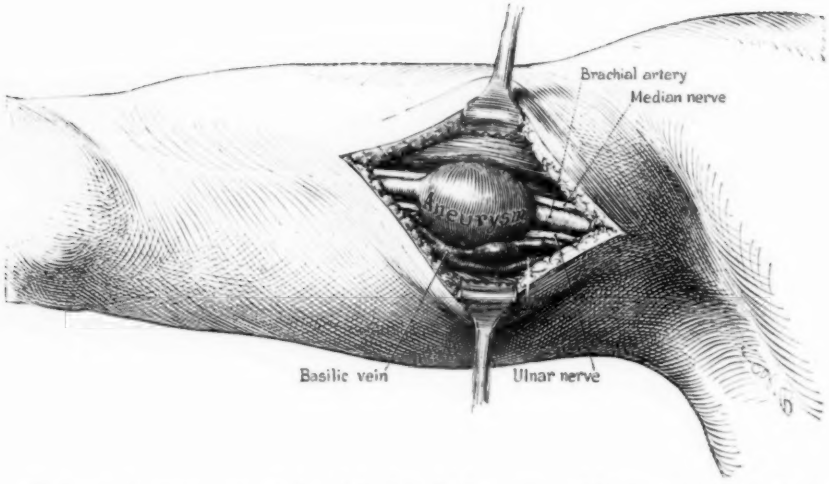



FIG. 5. Traumatic aneurysm of the right brachial artery, with accompanying thrombus of the basilic vein.

FIG. 6. Patient three weeks after reconstructive endoaneurysmorrhaphy for aneuryum of the brachial artery.

FIG. 7. Large aneurysm of the left buttock, patient lying partly on abdomen with left thorax slightly elevated. Before operation.

FIG. 8. Patient two weeks after operation for huge aneurysm of the sciatic artery.

that the Matas principle of suturing inside the sac, in whatever way may be indicated, has completely revolutionized the treatment of aneurysms, providing the surgeon mental, moral and physical equipment which never existed under methods previously practiced. Clearly endoaneurysmorrhaphy is not adaptable to all types of aneurysms. Ligations will continue to be done in certain conditions, for positive reasons or negative indications. But the Matas idea has prevailed, because it is founded on carefully thought-out postulates, because it is easily and safely performed and because it yields beneficent results. Those of us who have cared for aneurysms both before and since the régime of Matas are able to appreciate the difference; we now approach the aneurysm patient with a degree of confidence never known in the older period. For the successful issues in my limited experience all honor to Rudolph Matas.

# HALSTED THIRTY-SIX YEARS AGO

(WILLIAM STEWART HALSTED, PROFESSOR OF SURGERY, JOHNS HOPKINS UNIVERSITY AND CHIEF SURGEON, JOHNS HOPKINS HOSPITAL, 1889–1922)

JOSEPH COLT BLOODGOOD, M.D., F.A.C.S.

BALTIMORE, MD.

IT WAS my good fortune, through William Osler, to receive an appointment on Dr. Halsted's staff of the Johns Hopkins Hospital in May 1892, thirty-eight years ago. Before coming to Baltimore I had witnessed some of the operative and experimental work of Nicholas Senn in Milwaukee and of his associate Dr. Mackey. Senn was familiar with the best in German surgery and Mackey the Edinburgh school. Then there were my four years in Philadelphia with periodic visits to New York and Boston. After spending about six months of a very intensive experience with Dr. Halsted in his Baltimore clinic, I visited the clinics in most of the countries in Europe for a period of almost one year. When I returned to Baltimore I was given the opportunity to work directly under Halsted as his resident surgeon.

I have had for many years, even before Dr. Halsted's death in 1922, a hope that I should find time and opportunity to record my memory picture of this great surgeon's conceptions and executions in the science and art of surgery and surgical pathology.

Fortunately I delayed, because in this time of postponement, the greatest contributions of Halsted had crystallized and second, the proper opportunity has arisen. A congratulatory volume of papers is to be presented to Rudolph Matas, Professor of Surgery, Tulane University, New Orleans.

These two men, Halsted and Matas, were always unusually friendly and constituted what may be called a "mutual admiration society." I know this from what Halsted repeatedly

told me about Matas, and Matas' estimation of Halsted's friendship and contributions to the medical sciences has been published in the first volume of the Surgical Papers.

This brief statement becomes in fact a personal letter to Matas himself, for I know he will understand and enjoy a true picture of Halsted in the earliest decade of his great work, a period about which Dr. Matas can only read, because his personal acquaintance with Halsted began later [1903].

The year 1894, thirty-six years ago has been selected because at that time I could compare Halsted's conceptions of the science and art of surgery and surgical pathology with those of Senn and Mackey in Milwaukee, with my surgical teachers at the University of Pennsylvania up to 1892, and with the most prominent surgeons and teachers of surgery in New York and Boston. Then, after a period of one year and six months, in association with Dr. Halsted, I was in the fortunate position to compare this experience under Halsted with that under European surgeons.

There has never been quite such a period in medical science in all its branches since that decade from 1890 to 1900. During this time asepsis and antisepsis were established as well as practically all the surgical technique of incisions, exploration, closure of wounds and the most extensive dissecting operations for malignant disease.

For the statements made here from memory and which may not appear among the Surgical Papers of Dr. Halsted, I have verification in the records of the surgical histories of Halsted's clinic in Johns Hopkins since 1889.

The facts which I have decided to record are not selected because of their historical value *per se*, nor necessarily because they were Halsted's greatest achievements, but because of their value to the young surgeon and surgical pathologist of today. It is an attempt to record unadorned those conceptions and executions of Halsted as a surgeon and pathologist which are just as important today as then. Osler frequently spoke to us in early days at Johns Hopkins of the great value of a book or a series

of volumes which would record the fundamental contributions of men. All other statements and writings, no matter what their historical worth, should be disregarded in this so-called abridged edition of the writings of the great masters.

*Surgical Technique. Antiseptic and Aseptic Surgery. The Bloodclot in the Management of Dead Spaces and the Treatment of Wounds.* These are the titles used in the first volume of Halsted's Surgical Papers by the editor in grouping together a number of writings. All of these contributions of Halsted, except one on aseptic surgery, which was made in New York in 1884, were written by Halsted in the first few years after the opening of the Johns Hopkins Hospital in 1889.

I know from personal conversations that all of these principles were conceived and most of them practised by Dr. Halsted in his brief surgical career in the hospitals in New York City. So really my record of his conceptions and execution of aseptic and antiseptic surgery should go back to 1884 at which time the contrast of his technique with that of others was greater in favor of Halsted than later.

It may be stated here that Halsted's technique to prevent the infection of a clean wound and to take care of an infected wound ranked with the best in the world, and there were very few surgeons whose execution equalled that of Halsted during his operations at Johns Hopkins Hospital. As recorded by Halsted in his writings and as observed by his associates, the only change in the operating-room technique since 1889 is a long-sleeved gown, rubber gloves and the face mask. That alcohol has been substituted for permanganate of potash and oxalic acid followed by immersion in 1:1,000 bichloride may save time, but we have no evidence that it is a better preparation. The present disinfection of the hands also saves the hands of the surgeon. Both the solutions of bichloride of mercury and carbolic acid were irritating to the hands. Some of Dr. Halsted's associates still use this technique, and one only has to look at their hands to know it.

Halsted boiled his instruments in a soda solution as recommended by Schimmelbusch, and placed them in a 1:30 solution of carbolic acid, because the soda solution made the instruments too slippery. Even after this he still feared the danger of recontamination of the instrument during the operation. Also, in the early years, even clean wounds were irrigated with 1:1,000 bichloride of mercury, except, of course the peritoneal cavity. This was ultimately given up, because in spite of it wounds suppurated and there were a few cases of poisoning resulting in a few deaths.

In all the conversations that I had with Halsted, Welch and others I never could get any evidence that the extensive experimental work so persistently pursued at Johns Hopkins Hospital during the first few years had any influence whatever on the technique in Dr. Halsted's operating rooms, or in the wards. That is, Halsted started his operative technique at Johns Hopkins in 1889 as a finished product, which must have been thought out and practised in New York.

Evidence in favor of the perfection of Halsted's technique is found in the actual healing of his wounds, as compared with the wounds of other surgeons throughout the world. No one, however, at that time had accomplished the practically perfect healing of every clean wound which had been closed without drainage.

Halsted, however, failed in his delayed recognition of the full value of rubber gloves. There is no question that the rubber gloves were in the operating room in 1889. The intern who handed the instruments which were immersed in carbolic acid wore rubber gloves to protect his hands from the carbolic acid. The nurse who squeezed out the gauze sponges wet in 1:1,000 bichloride of mercury solution also wore rubber gloves, because Halsted felt that the more gauze was handled by the bare hands, the greater was the danger of hand infection. He also knew that no method of hand disinfection had yet been devised which would entirely eliminate as a source of infection, by the most virulent pyogenic organisms the bare human

hand and the skin in the field of the operation. Gloves in Halsted's operating room were in constant use by two members of the operative group and occasionally used by Halsted himself in operating upon joints, yet, it was seven years (1896) before it became the practice of everyone who cleaned up for the operation to wear these gloves as a routine.

The moment this routine use of gloves was adopted the suppuration of closed wounds, for example in inguinal hernia, fell from more than 9 per cent to less than 0.5 per cent.

Since this period (1896 to 1898) there has never been a time when the healing of closed clean wounds without drainage exhibited such perfect results.

I can not here write the chapter of the effect of the first and subsequent epidemics of influenza and its concomitants on the infection of wounds during operations.

Just why did Halsted's unusually accurate, keen and original mind fail to realize that the handling of silk which he buried in wounds was just as dangerous as the handling of sponges by the nurse, when he gloved the hands of the nurse, but not his own?

Before the routine wearing of gloves Halsted had substituted buried silver wire for silk, not because he wanted stronger suture material, but because silver wire was the only metal that could be safely buried and had definite antiseptic action. Very quickly after gloves were employed Halsted returned to the use of buried silk for sutures and ligatures and experienced practically no trouble.

Apparently Halsted was not responsible for the introduction of the gowns with long sleeves and the mouth-piece. With the exception of this, Halsted's technique for the protection of wounds made at operation, or at least the principles of this technique, are universally accepted today.

*Handling of Tissues.* When I came into the operating room in Johns Hopkins Hospital in May 1892 and assisted at operations, I was most impressed with Halsted's gentle handling of the tissues. He cut with the knife, blunt dissection was a

horror to him. He employed a fine straight clamp, so that only the least bit of tissue would be crushed in catching the bleeding point. In ligating this he used the finest silk, first, because it would leave the smallest foreign body in the tissue; second, if one used force to tie the knot, the silk broke, thus preventing strangulation of the tissue. No surgeon up to this time whom I had seen operate seemed to have equalled Halsted in gentleness in cutting tissue, in clamping of bleeding points, or in employing the sponge and in retracting. This was an invariable rule in all operations.

*Ligatures and Sutures.* The employment of fine black silk as a ligature and a suture when the latter was possible characterized the Halsted clinic, and most of the men trained under him still prefer the fine black silk when possible. Halsted abhorred catgut. In the first place, he was skeptical of whether it could be properly sterilized. Postoperative tetanus was still being observed, on rare occasions, when wounds were closed with catgut. This danger now, of course, is over. For larger vessels he employed a heavier silk for ligation. For the closure of deeper wounds where the fine silk did not seem to be sufficiently strong, he used heavier silk, but later changed this to buried silver wire and reduced the number of wound infections and stitch sinuses. In later years, after the introduction of gloves, he returned to fine silk for the closure of the hernial wounds, and in the development of his operation for the excision of the thyroid gland. Irrespective of the pathologic condition he preached and practised to the end of his operative career the employment of the fine silk for all ligatures during this bloody operation. I observe that today many of the younger men are beginning to learn that if they use fine silk during thyroid operations, fewer infections of the wound follow. Halsted wrote in 1890:

> I believe that the obstruction to the circulation produced by sutures and ligatures is often the immediate cause of suppuration in infected wounds . . . The complete strangulation of large masses of tissue we try to avoid by using very weak silk . . . The occasional breaking of the silk reminds one that he is tieing with too much force.

This danger is not so great when gloves are employed and wounds are drained. I have observed continuously from the time I saw Senn operate in Milwaukee in 1885 up to today and in the majority of the operating rooms that surgeons seem to fear to use weaker catgut or silk for ligatures or sutures, and when they tie they use too much force. I find that in most of the operations fine black silk or 00 chromic catgut meets the demands.

*Checking of Hemorrhage.* Halsted outdid Pean in the number of clamps employed during an operation and in the number hanging to the wound at the same time. In spite of the number of surgeons that I witnessed operate in this country and abroad, I never found one who equalled Halsted in the almost absolute bloodlessness of the operative procedures.

Gentleness in the handling of tissues, in the ligation of bleeding points, the use of fine silk, and the checking of hemorrhage and the closure of wounds as a rule without drainage characterized Halsted's operative technique as that of an early master, and all the fundamentals which he worked out then more than forty years ago, hold good today. As he did not wear gloves in the early years, the dangers of the least change from his protective technique were greater than today when the operator has the protection of gloves.

*Drainage.* Most surgeons in 1890 were draining the majority of their wounds. Halsted rarely drained any wound. All of his resections of joints for tuberculosis were closed without drainage. When wounds broke down he opened them and washed them out, but did not introduce drainage. In 1893 I assisted Dr. Halsted in the reamputation of the arm of a very intelligent geologist. The first amputation had been performed on the field of battle; the wound had been closed without drainage. This patient remembered the months of agony during which the suppurating wounds healed by granulation. Then there was a second amputation because of a neuroma, and the wound was drained and dressed frequently. This patient was very much disturbed when the wound was

not dressed for two weeks, and when it was exposed and the patient was unable to see suppuration or a drainage tube he remarked that it was one of the greatest wonders in the world, in spite of the fact that he was in command of the first party that successfully shot the rapids of the Colorado river through the Grand Canyon. Halsted felt that drainage tubes and gauze packed into clean wounds acted as foreign bodies, lowered the resistance of tissues to infection, and the tube and gauze coming out into the open air left a portal of entrance for secondary infection. It was his opinion that if a wound required drainage, it should be left open, and if a clean wound became infected, it should be opened at once. Even in those earliest years, if there was any sign of fever, it was Dr. Halsted's practice to open the wound at once sufficiently to get a drop of serum for a cover-slip examination, and if organisms were found in the serum, the wound was gently opened in one or more places and washed out with 1:1,000 solution of bichloride of mercury.

When a joint was opened because of infection the joint cavity was thoroughly irrigated with bichloride, but no drainage material of any kind was introduced into it. One or both lateral incisions made for washing out the joint were left open for drainage and repeated irrigations if necessary. Years ago I made a very elaborate report on the success of this method in joints infected with the gonococcus, the streptococcus, the pneumococcus and the staphylococcus. This method of treatment only failed when we overlooked the bone focus, and in a few instances the infection of the joint secondary to the focus in the bone was checked and the joint wound healed, and joint motion was partially restored before we suspected, discovered and opened the infection of the bone.

When Halsted found it necessary to drain he used as a rule iodoformized gauze, very abundantly, now and then combined with rubber tissue. When for some special occasion or indication he felt it necessary to keep one or more channels open into a closed wound, Dr. Halsted employed rubber tissue to the preparation of which he gave much attention. The object of

this rubber tissue was to drain a space in the wound with the least traumatism that would allow vent to any secretion and could be removed with the least danger of producing hemorrhage in the granulation tissue. This rubber-tissue drainage which has been largely supplanted by thin rubber-glove material is still one of the essential features of proper drainage unless we propose to carry on, if indicated, the Carrel-Dakin method of continuous flushing with the disinfectant.

As I think over Halsted's discussions and practices in the treatment of infections and postoperative infected wounds I feel that he almost grasped and anticipated the Carrel-Dakin method. The one or more tubes used by Carrel are equivalent in their non-irritating effect to rubber tissue, but these tubes allow the almost continuous flushing of the wound with the Dakin solution. Halsted conceived the necessity of frequently irrigating an infected wound with an antiseptic. He used 1:1,1000 bichloride solution which, we now know, is too strong. However, when Halsted applied the almost continuous irrigation in gonorrheal urethritis, he started with a very weak solution, gradually increasing its strength.

*The Management of Dead Spaces.* A discussion of this problem has a very large space in my memory centers, but I can not express it better than in Halsted's own language:

> Of great consequence is the management of the dead spaces in wounds. These may be obliterated, drained, or allowed to fill with blood. The more imperfect the technique of a surgeon, the greater the necessity for drainage. The most rigid antiseptic precautions are demanded for the obliteration treatment of dead spaces.

There is no question that many of Halsted's intended blood-clot closures of dead spaces succeeded, especially those in which the cavities were swabbed out with pure carbolic acid and alcohol. In such instances Halsted followed Lister's technique in the treatment of compound fracture. This was the beginning of antiseptic surgery. Lister described the healing of a blood clot under a scab in 1865. Halsted was constantly attempting it in the early years of his operative experience.

Later he was rather inclined, when the dead space could not be obliterated, to drain it. Nevertheless this strenuous attempt deliberately to fill a dead space with blood after disinfection, and to close the wound, must have had a beneficial influence in the development of as perfect a technique as was possible with asepsis and antisepsis before the employment of gloves.

When I entered Halsted's clinic in May 1892 as his youngest assistant he told me to read everything that Lister had written. When I went to the little library in the Johns Hopkins Hospital I had no difficulty in finding the correct places in all of Lister's articles published in the *Lancet* and in the *British Medical Journal*. Each article was indicated by a torn piece of blue paper which Dr. Halsted always employed in his correspondence. Thirty years later, when we sat in Halsted's library during his funeral services and I looked about on the books on the shelves around the four walls, I could see protruding from the top of almost every volume little pieces of blue paper. I advise any young surgeon who reads this article to do as I was advised by Halsted: read everything Lister wrote. To this I would add: Learn by heart everything that Halsted has written in his Surgical papers recently published in two volumes. Then get hold of the best literature on the Carrel-Dakin method in the treatment of wounds. Then you will be prepared to aid in the problem of the protection from infection of our operating wounds today when even a mild epidemic of respiratory diseases occurs in your community and in your hospital.

There is no question that in the majority of surgical clinics today during the months most free from respiratory infections, there is the least number of wound suppurations. Since the pandemic in 1918 it has become even more evident, because more frequent and less virulent, but almost annual outbreaks occur. My colleague Dr. Ford, of the Department of Bacteriology of the School of Hygiene of Johns Hopkins University, expresses the opinion that the organisms come from the mouths

of individuals in the operating room who are nearest the wound. The gauze mask over the mouth and nose is not sufficient. It is his opinion that cultures and cover-slips should be taken of the mouths of all who enter the operating room and when virulent organisms are found these individuals should be excluded. At the present time in the operating rooms at St. Agnes Hospital, we are not only flushing the wounds, other than those made at laparotomies, at the end of the operation with Dakin's solution, but introduce rubber tubes into the most important dead spaces and flush them continuously for some hours. Just as we started this method there was a decided drop in respiratory infections.

No one seems to be giving these occasional wound infections during the height of an epidemic the attention they should receive. We must remember that Lister and his followers achieved remarkable success in dirty hospitals filled with pyogenic organisms. Halsted and his associates were aided, because they were working in clean modern hospitals. Nevertheless under these most favorable conditions and before the routine employment of rubber gloves the introduction into the hopsital of a streptococcus infection or a case of erysipelas was usually followed by a streptococcus infection of a clean operative wound, provided one of the surgeons or nurses whose hands came in contact with the discharges from the streptococcus wound assisted at an operation within a few days. I have reported such instances occurring in the early years of Halsted's clinic, and it was these investigations that lead to the routine employment of gloves not only in the operating room, but in the dressing of all infected cases in the wards, whether isolated or not. It was not until 1918 that surgeons realized the great danger of the infection of clean operative wounds during an epidemic of influenza and pneumonia, and in the twelve years since then nothing really has been done to investigate the problem properly, in spite of a number of deaths even after such simple operations as the submucous resection for a deviated septum.

*Halsted in His Operating Room.* Unlike most European operators especially in Germany and Italy, Halsted began his operations at ten or a little after. Observe the table, Figure

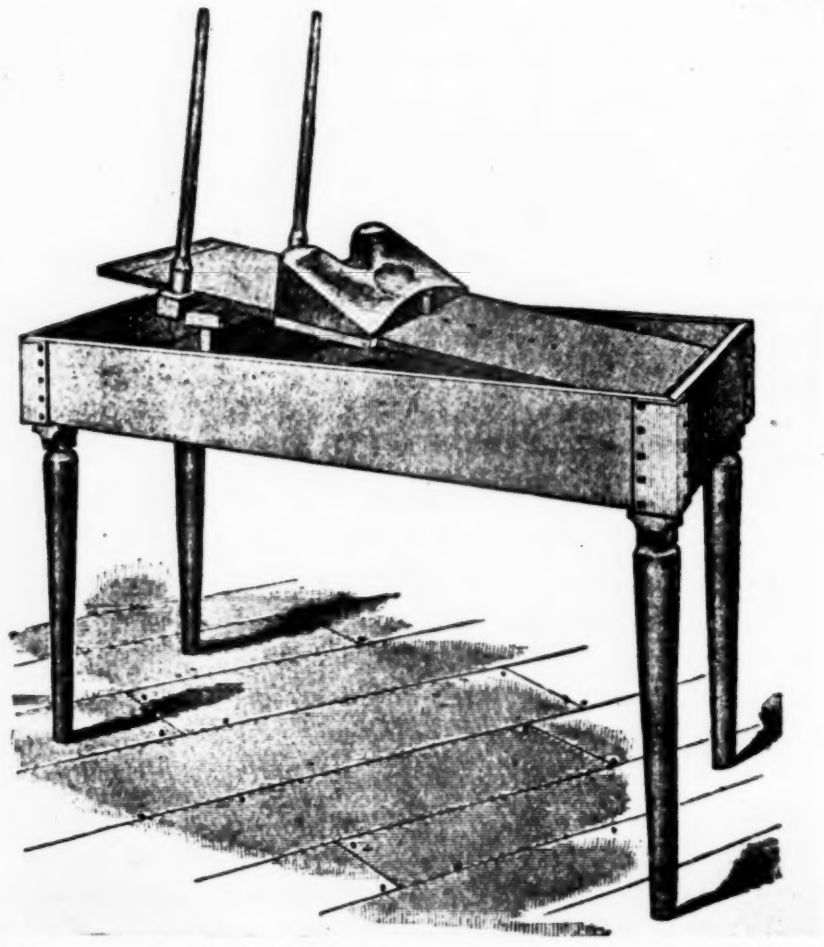
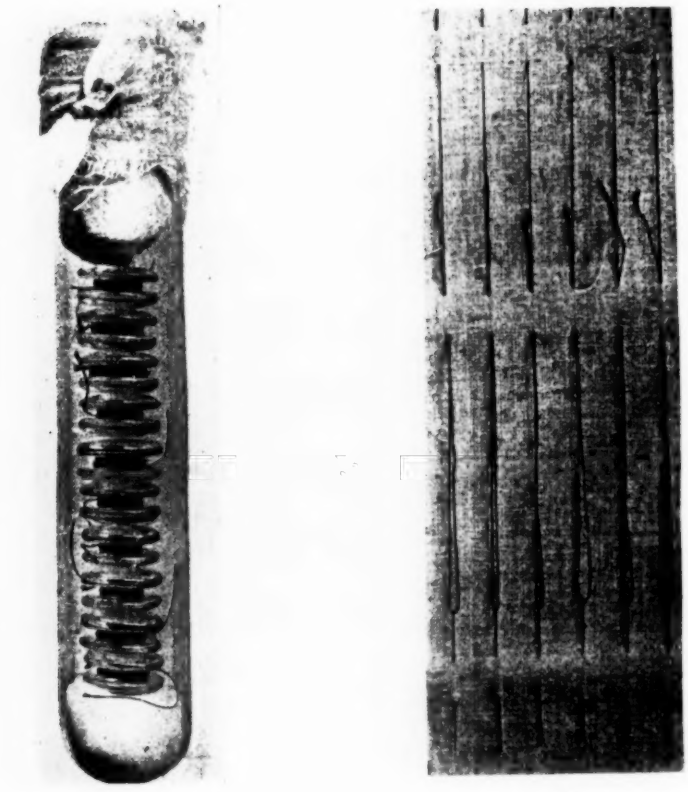


FIG. 1. Halsted's table with perineal board. The patient was anesthetized and lifted into position. The table allows irrigation of the wound without flooding the operating room floor. Halsted anticipated all the modern arrangements for gynecological pelvic operations, prostatectomies. He used this chiefly for hemorrhoidal operations and the Kraske resection for cancer of the rectum.

1. Like everything in the operating room it was built of wood. All the surfaces of wood were kept clean and waxed. The board is shown in Figure 1. When the perineal board was not employed, it rested on the two ends of the table, so that any

irrigation employed in the wound could be caught in the open box table beneath. Trendelenburg position could be easily maintained by lifting the ends of the board, but we had no shoulder strap, so that an orderly had to hold the legs. In this operating table Halsted gave one of his few examples of inattention to some important details. For example, the difficulty of maintaining the Trendelenburg position, and the fact that the patient's arms had to be held by a nurse or orderly during the operation for cancer of the breast with the danger of over extension and temporary brachial plexus paralysis. With very few exceptions the fundamental principles of every detail of the entire operative technique from the preparation of the patient the night before, to the return of the patient to the ward, had been worked out by Halsted himself. These are still very worth while reading by internes and nurses to help them in their operative room behavior. In all my experience, up to that time and since, I have never witnessed such intelligent and conscientious attention to the most minute detail. The nurse who rolled the silk on the glass spools and threaded the fine silk in the fine, straight intestinal needles (Fig. 2) or prepared iodoformized gauze, cleaned up as for an operation, and in my recollection wore rubber gloves. I can find no statement as to this, nor photographs. All gauze and towels, and sheets were sterilized by steam in the Arnold sterilizer by the fractional method, I think for one hour or more, daily for three days. This had its disadvantages in an emergency or when the stock was exhausted in one day, because of many emergency operations. At this time at von Bergman's clinic in Berlin the single sterilization in cylinders, under pressure, were employed. That was the result of Schimmelbusch's experimental work. I do not remember it in this country, at this period. Halsted was most particular about the preparations in everything he employed, regardless of expense of money, and the time or energy of those upon whom this duty fell. It was shown in the adhesive straps, the special bandages, the extension apparatus for fractures. To repeat, I have visited



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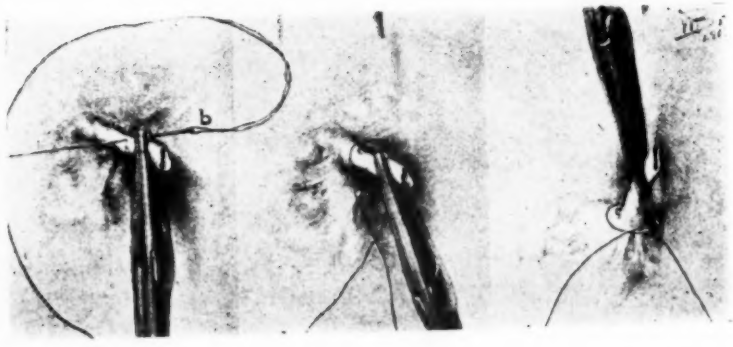


C

FIG. 2.

many clinics throughout the world, but in not a single surgical clinic was the chief so absolutely responsible for every detail, most of which he had thought out himself.

It is to be remembered that Halsted had a quiet period between the end of his intensely active operative and teaching career in New York City, and his launching of the surgical clinic at Johns Hopkins in 1889. There is every evidence that he employed this in experimental work in Welch's Pathological Laboratory, in thinking and in testing out by operations on dogs, the finest details of aseptic and antiseptic technique based upon his experience in New York. We must also remember that during the period when the work in the Welch Pathological Laboratory represented the activities of the new hospital group, there was a very intense study of hand disinfection, and this continued during the early years of the hospital. However this bacteriological investigation failed, because it did not lead to the long sleeved gown and the rubber glove.

Halsted was the first operator with whom I came in contact, who insisted upon operating with the smallest amount of ether anesthesia. In Philadelphia I was always told to give more ether, by Halsted to give less ether. In the Johns Hopkins Clinic the chief surgeon also employed a cone, which allowed the giving of ether with more air.

In the preparation of the patient, during the entire operation, and in postoperative treatment, Halsted was one of the few surgeons of his time to think constantly of the prevention of shock. Keep the patient warm, reduce the amount of anesthesia, if possible, use local anesthesia, lose no blood, protect the intestines with gauze moistened in warm salt solution, specially prepared by fractional sterilization. Halsted had no faith in stimulants for shock beyond putting the patient in bed, elevating the foot of the bed, giving morphine sufficient to relieve pain and restlessness, and giving fluids by rectum. He employed no postoperative stimulation. We observed the least shock in our longest operation, the complete operation for cancer of the breast, because during this operation one

was able to control anesthesia, hemorrhage, and the gentle handling of tissue.

During the operation Halsted was a surgeon, a pathologist, and a thinker. He always had in mind improvements in the operative procedure and carefully studied every bit of tissue exposed by the knife.

The only omission which deserves criticism is that Halsted rarely dictated anything that he did or observed during the operation. This was always left to others. As I have a number of records written or dictated by Halsted himself during my resident surgeonship, I can estimate the great value if more of them had been left behind. In the years before my coming the resident who wrote up the operation, confined his notes to technique, the number of clamps employed, the detail of the skin incision, the time of the operation, and the closure of the wound. Naturally during my resident-surgeonship, due to Dr. Halsted's influence and suggestions, we made most minute note of the operative findings and the gross pathology, and after the operation voluminous notes on the gross and microscopic pathology. These appear in my records, but in the early years they largely represent Halsted's observations, of which I was chiefly the recorder. In all these contacts one was continuously impressed that Halsted was an intellectualist, with a most remarkable memory for what he read and what he observed with his naked eyes. He was not as interested in the immediate observations of microscopic pathology, as up until 1915 it was of no particular value in the operating room, and was just as useful to him in the form of a report. Halsted never lost his vigilance in observations of technique and tissue, whether he operated himself or observed an assistant.

I hope that the younger members of the surgical profession will read in detail in Halsted's Surgical Papers what he has recorded on technique. This is especially necessary today, because we do not command asepsis as we did in Halsted's operating room from 1896 to the pandemic of the influenza in 1918. We have also forgotten the value of surgical bacteriology

in the operating room and have neglected the study of every type of infection, wound or not. The value of disinfection with antisepsis in the earliest hours of the contamination of the wound, learned during the War, is being considered *less and less* today.

Halsted gave surgical bacteriology and pathology an equal place in his department, both in the operating room and in the wards, as well as in Dr. Welch's Department of Pathology.

## BREAST

*Halsted's Complete Operation for Cancer of the Breast.* Billroth's conception of the complete resection of the stomach for cancer antedated Halsted's complete operation for cancer of the breast, but Billroth laid no stress on the complete removal of the glands in the lesser and greater curvature. Halsted seems to have been the first to conceive the *en-bloc* dissection of the primary tumor with the neighboring lymphatics and all other tissue which might be involved by direct infiltration of the cancer cells, whether into the lymphatics or to zones about the original tumor. Halsted's complete dissection of the breast, the axillary glands and large portions of both pectoral muscles went as far as was anatomically possible. There is no question that this *en-bloc* dissection was conceived and executed before he came to Johns Hopkins Hospital in 1889. However, in his first report on fifty complete operations in 1894 the first operation recorded is May 28, 1889, and no mention is made of previous operations in New York.

Halsted was never able to describe his technique in detail, nor has it ever been properly illustrated by drawings or photographs. The technique can really only be learned by assisting someone who has acquired the details from one of Halsted's associates who learned it while assisting the originator himself.

Figure 3 (P.No.227) is a photograph of the oldest living patient operated upon by Dr. Halsted for cancer of the breast. This was in 1892, thirty-eight years ago. This patient today at the age of eighty-two is in good health. You will observe

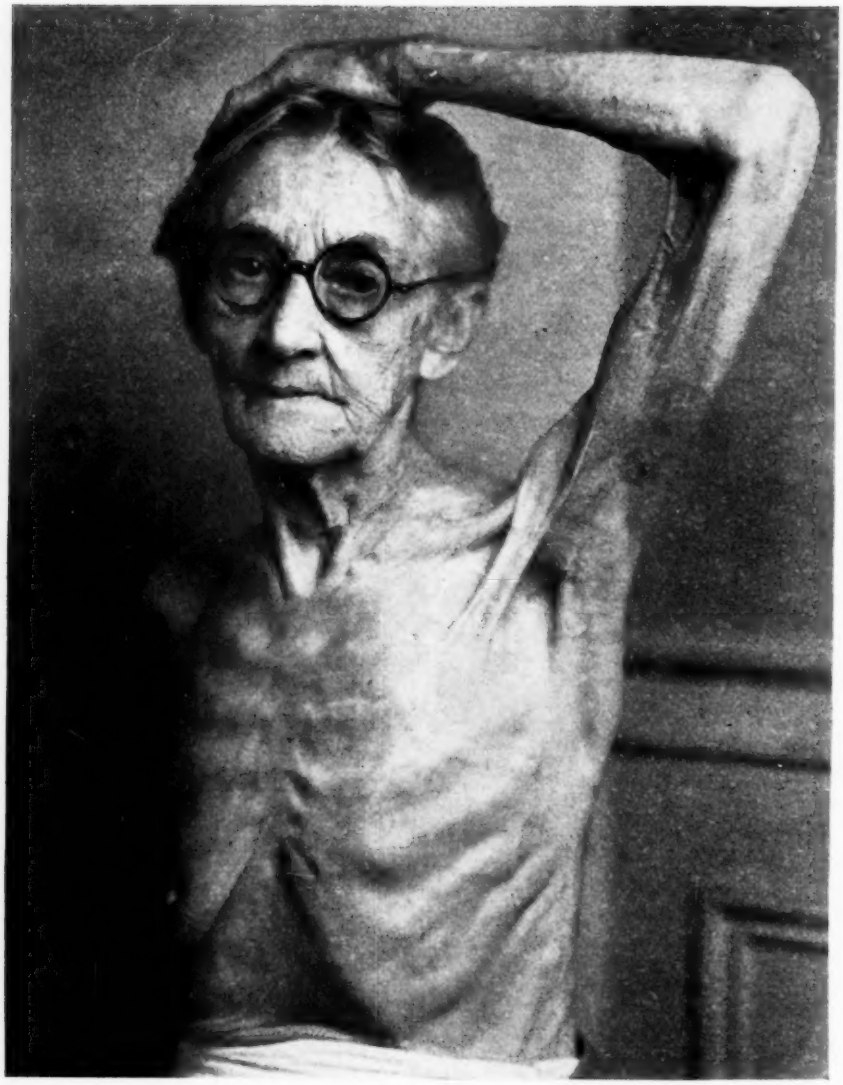

FIG. 3. Photograph of result thirty-eight years after Halsted's complete operation for cancer of the breast.

that there is no swelling of the arm and perfect use of it. The wide scar on the chest wall represents the wound that healed by granulation. Skin-grafting of the open wound was begun in

FIG. 4. Brödel's diagram of Halsted's incision. Note that the tumor, not the nipple, is the center of the skin area.

1893. You will also observe that there is practically no pectoral muscle visible. The fold of skin passing from the chest wall to the arm is scar tissue and indicates that in the early years the skin incision extended down on the arm. This is the usual result after a properly performed Halsted operation.

Figure 4, the drawing by Brödel[1] made in 1893 demonstrates that the area of skin encircles the tumor and nipple and then removes sufficiently more skin to allow the complete removal of all breast tissue. Operators even today, when confronted with the earliest and smallest breast tumor, should still follow Halsted's original idea that the tumor should be the center of a circular area of skin; then this circular area of skin can be given more margin which will include the nipple and sufficient skin to allow the removal of the breast and leave behind skin of good circulation. The margin of skin given the

[1] Plate XLIX of Halsted: Surgical Papers, 2: 50.

palpable tumor increases with the size of the tumor and with the involvement of the skin. When one explores a doubtful breast tumor today, the incision should be curved or straight

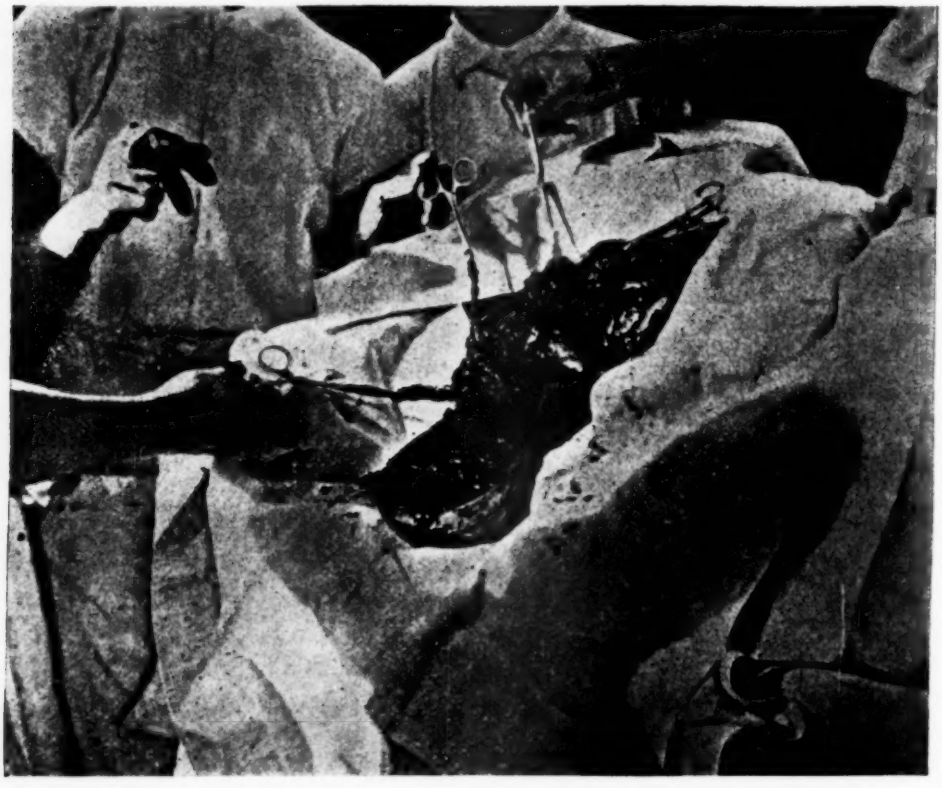

FIG. 5. Photograph of the end stage of Halsted's operation taken about 1893.

according to the position of the tumor, so that should the tumor prove to be malignant this exploratory wound can be included in the area of skin which should be the proper area for the removal of the tumor of the size and character explored. Figure 4 is positive evidence that Halsted dissected the skin clean from the subcutaneous fat. Everyone who looks at Figure 6 will agree that the artist has at least portrayed what the operator was most anxious to accomplish—an absolutely clean dissection.

Figure 5 (Plate 11) is a photograph of an operation for cancer of the breast in Halsted's operating room at Johns

Hopkins Hospital in 1893. Proof that rubber gloves were in Halsted's clinic at that date is given in the picture of one hand of which two gloved fingers are shown. This is also positive

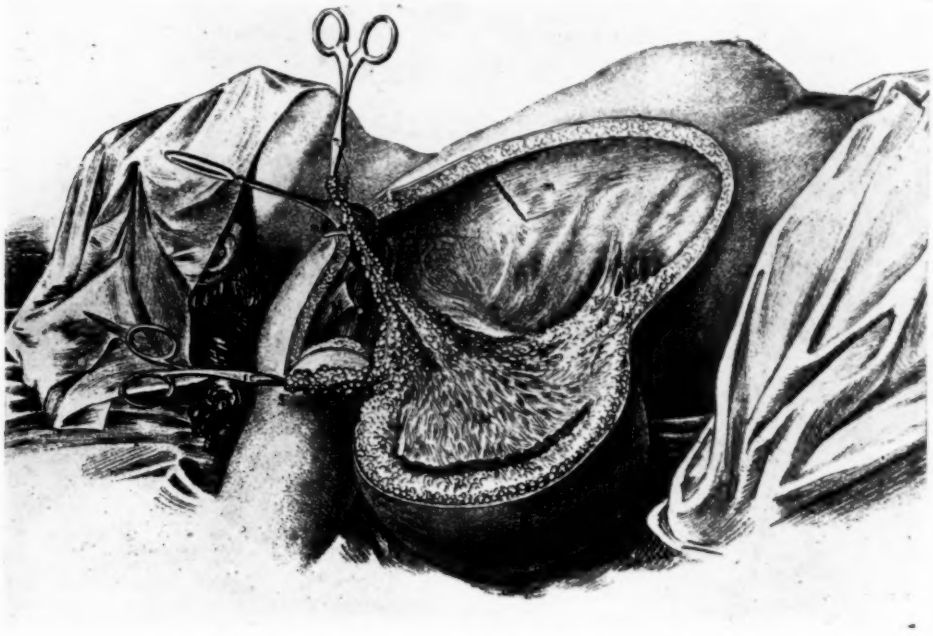

FIG. 6. Brödel's drawing of the last stage of Halsted's operation.

evidence that he saw no necessity of putting on the entire glove. I have looked in vain for a photograph which would show the nurse or the one who handed instruments wearing gloves. Observe how wonderfully and perfectly draped is the operating field and how conspicuously exposed the hands and arms of the operating team. Everyone connected with surgery was too slow in developing the full technique of aseptic surgery. Most surgeons caught from Lister too much faith in antisepsis.

Figure 7 shows the extent of Halsted's complete dissection.

However, there has never been an illustration, either by artist or photographer, that has reproduced the essential technique of this dissection for the removal of the breast, the muscles and the axilla. That its result is no more disfiguring than the removal of the breast is illustrated in Figure 3.

The actual results five years after operation in every type of cancer with and without axillary involvement and with different extent of axillary metastasis remain as published

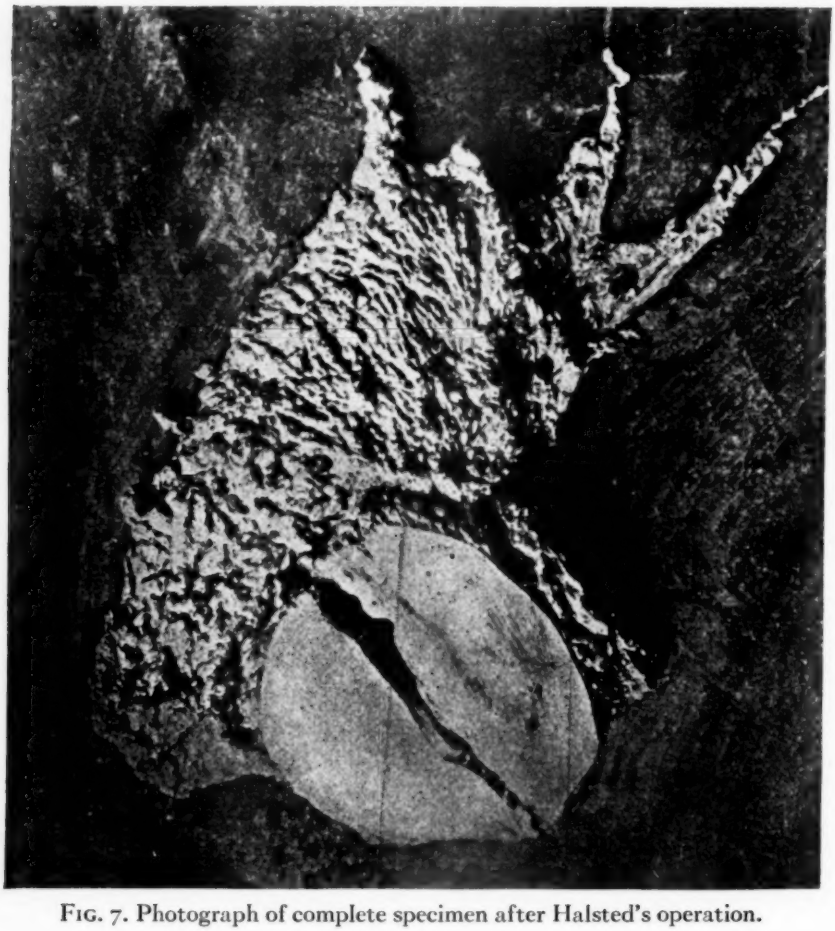

FIG. 7. Photograph of complete specimen after Halsted's operation.

by Halsted himself. I am unable to find any evidence from the larger number of operations that there are any more five-year cures or any fewer local recurrences. From an actual operative standpoint the results of the operation performed by Halsted himself, from my studies, have not been improved upon. Nor have I any evidence that preoperative and postoperative radiation has increased the five-year cures. We are not discussing its palliative effects. It is rather interesting that the

same may be said of Billroth's first operation for cancer of the stomach, known as Billroth 1, in which, after pylorectomy and partial gastrectomy, the duodenum is sutured to the stomach. In fact, most gastric surgeons have returned to Billroth 1 whenever it is possible. When indicated, Kraske's technique for the resection of the lower rectum and anus cannot be improved upon. We have had to give up Wertheim's more extensive resection for cancer of the cervix, first, because it has never accomplished a cure when the glands were involved and was unnecessary when the glands were not involved. In spite of the fact that, theoretically, it removed more of the tissue around the cervix, the margin was not sufficient to justify the added risk.

There is no added risk in following Halsted in his perfect and complete dissection for cancer of the breast. As, yet I can find no justification for attempting this any longer with the electric needle.

Halsted's five-year results were as follows: When the highest apex glands were involved 10 per cent of the cases were living apparently free from disease at the end of five years. If the mid-glands were involved 20 per cent were apparently well after this period; when only the base glands were involved the five-year cures were only 25 per cent. These figures were determined in our first study of the five-year results in about 1898. Halsted, in previous publications, selected the three-year limit so there could be comparison with statistical studies already in the literature. Every restudy since then up to date shows practically no variation. I am not prepared to give here the ten-year results. I am attempting chiefly to give the evidence that Dr. Halsted not only conceived, but executed the type of a complete operation for a cancer of the breast which remains the operation of choice today.

In Halsted's clinic each year that the five-year results were restudied the percentage of the total number of cured cases increased. This can be explained by the lessening extent

of the axillary involvement, because, if the axillary glands are not involved, the five-year cures were originally placed at 85 per cent, and ultimately and today are placed at 70 per cent. This apparent fall in the five-year cures of cancer of the breast without axillary involvement can easily be explained by the borderline breast tumors which up to 1915 were included among the cancers of the breast. Since then they have been excluded from such studies. It is this group of borderline tumors without axillary involvement that has always influenced the percentage of five-year cures in every surgical clinic. Very few clinics even today can give their percentages with involvement and non-involvement of the axilla, and still fewer have accurate records of the extent of the involvement of the highest apex glands, and as the five-year figures vary from 10 to 75 per cent, it makes comparison of five-year cures in the different clinics difficult, as well as estimating the curative value of preoperative or postoperative radiation. I feel that I am justified in making the statement that Halsted not only established the fundamental principles of a complete operation for malignant disease, but the fundamental principles of its pathological study and the compilation of records which would make statistical studies of the greatest value.

The surgeon today is confronted with dilemmas both in the diagnosis and in the treatment of lesions of the breast. In the first place, he must decide by palpation whether there is a lump justifying operation. In the early years of Halsted's experience there was no such difficulty. There was always a definite lump. Halsted was one of the first to personally make so detailed an investigation of the distinction by physical signs between a benign and a malignant lump in the breast. In my opinion this work of his equals that of Laennec. He was opposed to exploration for diagnosis unless all the signs favored benignancy. Halsted's biopsies in 1892 when I first assisted him were as carefully thought out and worked out as today. I will discuss this under pathology. The present-day surgeon and pathologist should be better prepared to settle the dilemma

of diagnosis at the exploration of a breast tumor, because the number of cases today is greater in one year than in Halsted's first ten years of experience.

A further difficulty of the present-day operator is the decision between preoperative and postoperative radiation, and then, when shall the operation for cancer of the breast be restricted. Halsted again and again made the statement which I have been unable to find in his writings: "The surgeon who operates for cancer of the breast should make the incision best for the complete dissection and pay no attention to the closure of the wound. This closure should be performed later by another operator." I have been familiar with the actual results of the operation for cancer of the breast by Halsted and his associates and many other surgeons throughout the world, and there is every evidence that the results after the most complete and painstaking dissection of all that is necessary should be almost as favorable for function as the removal of the breast only. The case of the patient shown in Figure 3 (P.No.227) is selected not because it is the very best but because it is of the longest duration since operation.

All operations planned to avoid skin-grafting or to close the wound by some plastic procedure, or to leave more muscle are of no value. They do not add to function, but they may add to the risk of local recurrence. When the axillary glands are *not* involved, a restricted operation there involves no risk. It requires, however, an expertly trained operator to tell by palpation only whether the glands are involved or not. Today on account of the larger number of cases of cancer of the breast in which the glands are not involved, the danger of restricted axillary resection is less. Operators who restrict in any way the chest wall operation or the dissection of the axilla do so with risk to their patients both of local recurrence and of leaving an involved gland in the axilla. This risk increases with the extent of the local growth and axillary metastasis. Operators of wide experience in operations of this kind and with pathological knowledge may restrict the completeness of the

operation for cancer of the breast without any added risk to the patient. I know that Halsted never took this risk in spite of the fact that he encountered his share of early cases in the early years.

Halsted's painstakingly clean dissection of the axilla, his wider local removal of skin, subcutaneous fat, muscle and fascia equal his eminence in the thoroughness of his antiseptic and aseptic technique during operations. These two achievements alone have placed him justifiably among the greatest masters both in the conception of original ideas and in their execution, among the surgeons in the early years of modern surgery.

Contemporary literature, but more especially contemporary gossip, would give the impression that Halsted was a slow and somewhat awkward operator and lacked dexterity. This is absolutely untrue as regards those regions with which he was familiar. Halsted abhorred speed in operating which should be called haste. He did not wish to be known as a "brilliant" surgeon. However, in the dissection for the removal of the breast, muscles and axilla and for many other operations he could be and was brilliant in the execution. In the operation for cancer of the breast he used the knife blade throughout; everything was cut cleanly, there was no blunt dissection. Every bleeding point was clamped gently. Every branch of the axillary vein and artery was absolutely isolated from all surrounding tissues before it was clamped and ligated with fine silk. When his first two assistants were well trained, Halsted as the operator handled the knife, the dissecting forceps and now and then the sponge, rarely a clamp. The small so-called mosquito clamps were devised by him during the first years of my resident-surgeonship.

I feel that I am correct in stating here that I have never witnessed a surgeon perform a better or more brilliant and at the same time more careful and complete operation for cancer of the breast than Halsted. None of his associates ever surpassed him in this operative manipulation.

Again and again in my writings and teaching I have referred to Billroth, Halsted, Kraske and Wertheim as the four pioneers in the conception and execution of the complete operation for malignant disease wherever it may be situated.

## HERNIA

*Halsted's Radical Cure of Hernia.* When I graduated from the University of Pennsylvania in 1891 no surgeon discussed operations upon inguinal hernia unless there was strangulation. In this event all tried taxis first. There was a rumor that Dr. John B. Deaver had operated upon non-strangulated inguinal hernia in the German Hospital. During one year of internship in the Children's Hospital in Philadelphia, no opportunity arose to assist at an operation for strangulated hernia in a child. Halsted, however, and Bassini had both conceived and executed their operations, the principles of which are followed today. Both these originators of an operation for the radical cure of hernia were of the opinion that the cord was the cause of the hernia and its transplantation its cure. Both of them ultimately learned that the healing of the wound after a good suture of the external ring including the conjoined tendon was followed by a cure in the great majority of cases. In 1892 Halsted made his first extensive publication on his operation for hernia after an experience of 82 cases.

Figure 8* pictures Halsted's typical method. In all his writings Halsted stated that the problem in the cure of an inguinal hernia is to make and properly close a rent in the abdominal wall. When the rent was in the inguinal region there was an additional problem—the position of the cord. In the ordinary laparotomy there was no such problem. Very quickly he reduced the size of the cord by the excision and ligation of the accompanying veins, similar to an operation for varicocele practised before that time through an incision in the scrotum. The illustration shows the denuded cord after ligation of the vein; in the lower angle the stump of the ligated vein. It also

* Pl. xxi, Surg. Papers, p. 282.

demonstrates Halsted's failure either to describe or to illustrate some of the most important details of his operative technique. In the letters *a* to *v* the words "divided internal oblique" do

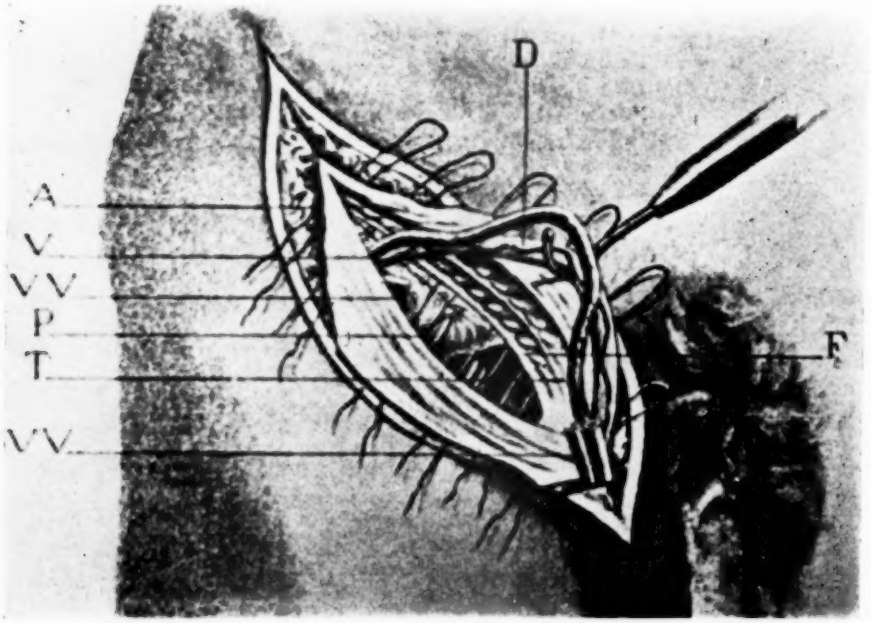


FIG. 8. Sketch of Halsted's operation 1892. *a*, aponeurosis of external oblique muscle; *d*, vas deferens; *f*, fascia transversalis; *p*, peritoneum; *t*, conjoined tendon; *vv*, stump of excised vein.

not appear, in spite of the fact that Halsted considered the division of the internal oblique muscle to allow the high transplantation of the cord as important as the transplantation of the cord itself and its reduction in size by the excision of veins. Fortunately he pictured the conjoined tendon (T) and taught all of us to be certain that the conjoined tendon was caught in the lowest one or two stitches. I am confident that my memory is right about this. This catching of the conjoined tendon in the last one or two stitches below the transplanted cord as practised by Bassini and Halsted, or above the cord, as emphasized by the majority of surgeons attempting to discover a cure for hernia by a new operative technique, is an essential feature of all operations for the radical cure of hernia. Never-

theless in Halsted's first description he neither mentions by name the division of the internal oblique, nor the importance of including the conjoined tendon in the lowest sutures. As to the tissues cut for exposing the sac Halsted writes: "Throughout the entire length of the incision everything superficial to the peritoneum is cut through." As to the closure of the wound, I quote: "Interrupted strong silk sutures, passed so as to include everything between the skin and the peritoneum, are used to close the deeper portion of the wound, which is sewed from the crest of the pubes to the upper outer angle of the incision."

Now, this can be easily done and the conjoined tendon not caught. This ignorance or carelessness explains many recurrences by other operators in the early years when the wound did not suppurate. In this first presentation of Halsted's in 1890 he emphasized the transplantation of the cord with its veins, the high isolation of the sac and its division and closure above the neck, and the importance of closing the skin with a very fine silk passed subcutaneously, interruptedly, in order to prevent the penetration of the skin with needle or silk. This idea of a subcutaneous stitch ultimately led to the continuous subcutaneous silver-wire suture. He was anxious to avoid the sebaceous follicles. The stitch originated from his experiments on dogs in Welch's pathological laboratory before the opening of the hospital in 1889. In 1889 he presented five operations for the radical cure of hernia before the Johns Hopkins Hospital Medical Society. It is also interesting to note that he used a gauze plug for drainage and then adds that the wound healed *per primam*, except where the gauze plug was introduced. In the last few cases he gave up the gauze plug drainage. I never saw him drain a wound made for the radical cure of inguinal hernia.

To demonstrate Halsted's firm conviction of the necessity of catching deeply the conjoined tendon, I quote from his note on Case 3: "Passes urine through the wound . . . Infer that one of the deep sutures was passed through the wall of the

bladder . . . The patient recovered, the wound healed by primary intention, except in the lower angle through which the urine leaked for a few days, then there was healing by granulation."

In October 1890, eleven months later, he makes another report to the hospital medical society in order to show the perfect healing of the wound and the employment of the sealing or collodion dressing. The patient he demonstrated was the patient just noted from whose wound urine leaked for a few days. There had been the complication of a thrombosis of the femoral vein. There is another important statement here again to demonstrate Halsted's emphasis on the importance of closing the lower angle of the wound: "We take such deep stitches into the pillars of the ring that I am not surprised at this complication." In spite of this statement Halsted was not a good prophet. It never occurred again in any case of which I had a record up to 1900. There is another quotation which again emphasizes Halsted's idea of the value of dividing the internal oblique: "The muscles of the abdominal wall are divided out to the level of the anterior superior spine of the ilium." This is a slight exaggeration, but the principle remains the same. In this very short note in 1890 there is another statement which again emphasizes Halsted's opinion of the value of the high ligation of the sac. He writes: "The walls of the sac are sutured by quilted suture at as high a level as possible." In an earlier paper he writes: "The abdominal cavity is closed by quilted sutures passed through the peritoneum at a level higher by one and one-half to two inches, than the so-called neck of the sac." In this second statement in 1890 he again mentions the transplantation of the cord and its vessels to the outer angle of the wound. Figure 8 pictures the buried mattress sutures which were first of heavy silk and later changed to silver wire.

In January 1892 Halsted presented to the Johns Hopkins Hospital Medical Society cases upon whom he had operated for the radical cure of hernia and added to his technique the

resection of the veins if large. Here is a quotation which again shows Halsted's feelings about the relation of the cord to recurrence of the hernia: "By this procedure the cord may often be reduced to less than one-fourth of its original size. It is reasonable to suppose that the size of the cord may influence the tendency of the hernia to return."

Now let us turn to Halsted's paper in 1892 from which I have taken Figure 8. There is a report of eighty-two cases. The paper was delivered in 1892 but not published till 1893, so there was the addition of some cases, but no new statement of facts. I was present when Halsted delivered this paper in November of 1892. Remember, this is almost forty years ago, and Halsted's writings show that the radical cure of hernia was one of the great problems occupying the minds of ambitious progressive surgeons. At this time the majority of surgeons of the world advised a truss for a reducible inguinal hernia, and with few exceptions operated only for strangulation. However, there were a number of venturesome operators who were attempting to find a cure by operation for an inguinal hernia. Halsted in his paper goes over the ground briefly, but sufficiently, so much so that when in 1899, seven years later, I made my report on 500 operations for the radical cure of hernia, I did not discuss the literature. I have already stated that ultimately we all learned that the chief cause of recurrence was suppuration. For example, in my studies in 1899, with the exception of those cases in which the conjoined tendon was obliterated, recurrence took place after Halsted's radical operation in from 1 to 6 per cent, while in suppurating wounds in from 7 to 36 per cent. In 1892 Halsted writes: "Shuh said: 'If no other field were offered to surgeons for their activity than herniotomy, it would be worth while to become a surgeon and devote an entire life to this service.'" As a matter of fact, from 1893 to 1899, during which time I was Halsted's resident surgeon, we devoted a large part of our time to the radical cure of hernia. Practically every patient was sent for and examined, and Halsted worked with me in the large report

which I published in the *Johns Hopkins Hospital Reports* in 1899. It was this study that led Halsted and myself to conclude that the division of the internal oblique was unnecessary, that the transplantation of the cord was also unnecessary, except when the conjoined tendon was obliterated, and then there must be a transplantation of the rectus muscle or of its sheath. There was no longer necessity to use silver wire or heavy silk, because the introduction of rubber gloves made buried silver wire unnecessary, and Halsted himself found that the wound could be closed in layers with the finest black silk used as an interrupted stitch. In his latest studies with Taylor, the chief cause of recurrence was not suppuration, but the failure of the individual operator to follow out the details of the closure of the wound, or to recognize the absence or partial obliteration of the conjoined tendon.

Halsted himself gives equal credit to Bassini. Neither knew of each other's ideas. When I visited Europe in 1893, I saw hernia operations chiefly in Bassini's clinic, in addition, a great many patients recovering from the operation. As I made rounds with the younger doctor in Bassini's clinic, I found the hernia wounds suppurating as frequently as in Halsted's clinic, and both chiefs of the clinics equally ignorant of the actual percentage of their wounds that broke down.

When I compared the operations of Bassini and Halsted as practised by the authors or their followers, there seemed no question that the chief feature of the Bassini and Halsted technique was the closure of the wound and not the transplantation of the cord. Also, these two surgeons had distinctly less frequent recurrences even when their wounds suppurated than other operators.

The last report on hernia from Halsted's clinic, by Taylor, clearly demonstrates that the perfect healing of the wound will not protect the patient from recurrence unless the operator is familiar with the proper technique of closure and follows it in painstaking detail.

In 1894 Halsted reported on the use of silver wire sutures as a substitute for buried silk sutures. Later came the covering of the wound with silver foil. In spite of this the suppurations were reduced to only 9 per cent. After 1896 the employment of gloves as a routine reduced the suppuration of wounds to less than 1 per cent. In 1895 Halsted wrote again:

> The problem is to close a durable rent in the abdominal wall and to provide for the safe transmission of the spermatic cord. The cord is the first cause of the hernia and the ultimate obstacle to its cure. The larger the cord, the greater the liability to a recurrence of the hernia. The size of the cord depends chiefly upon the vein. Then, why not reduce the size of the cord by excising the vein as may be superfluous?

Again in 1894 he emphasizes the importance of the division of the internal oblique. He writes:

> It has been demonstrated too often that the stitching of the pillars of the ring does not suffice. We must do more than bring free edges of the aponeurosis of the external oblique together. Fortunately we have muscles so near at hand and so placed as to suggest at once a simple and what has proved to be an entirely effective plastic operation. After cutting through the anterior wall of the canal down to the sac we continue the incision in the same line outward and a little upward, through the internal oblique and transversalis muscles for an inch or less.

This is the first time he has mentioned the internal oblique muscle.

Later Halsted made two very important additions to the operative technique: the employment of fine black silk as an interrupted suture in closing the different layers of the abdominal wall over the non-transplanted cord. Our catgut today is so good and the 00 sufficiently fine that there seems no objection to its use if there is any tension. However, I still prefer fine silk.

In 1903 Halsted reported on the transplantation of the sheath of the rectus muscle instead of the muscle itself and Figure 9 illustrates this. This was suggested as a substitute for the transplantation of the rectus as advocated by Woelfler and myself in 1898.

It was a great education to anyone to be with Halsted when he was studying in most minute detail the proper operation for the radical cure of hernia. It was some years before he

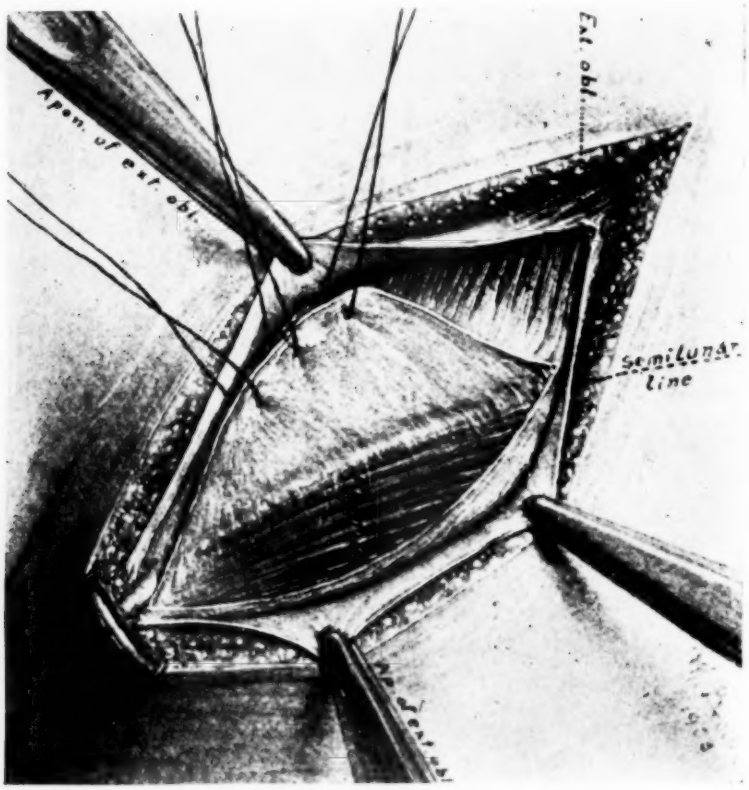


FIG. 9. Halsted's transplantation of the rectus sheath, 1903.

recognized that it was his method of suturing the wound rather than transplanting the cord that accomplished the results.

*Halsted's Operation for Inguinal Hernia as Performed by Him in Later Years.* Poupart's ligament and the aponeurosis of the external oblique muscle were carefully and completely exposed. Then the aponeurosis was divided from the external ring until the inguinal canal and the internal oblique muscle were exposed, and the rectus sheath in the lower angle brought well into view. The covering of the sac, whether it contained much cremaster muscle or not, was divided, carefully, and preserved. The sac was separated, clean from all its surround-

ings, and the peritoneum above the neck of the sac exposed. The sac was opened, its contents inspected and managed, the internal ring was always divided, so that the peritoneum could be closed above the neck of the sac, and the sac removed. The conjoined tendon was carefully palpated and inspected. If it was wide and strong the layers were approximated with interrupted, and as a rule single, fine black silk, now and then a mattress suture was employed. The coverings of the sac were first approximated, then the conjoined tendon and the edge of the internal oblique muscle were sutured to a fold of Poupart's ligament and the aponeurosis of the external oblique, some distance from the edge. The cord had not been disturbed and the lower suture fitted snugly over the cord. The internal oblique muscle had been so separated that it was loose and could be approximated to Poupart's ligament with the conjoined tendon without tension. Then the edge of Poupart's ligament and the aponeurosis of the external oblique muscle were sutured to the rectus sheath, the fascia of the linea semilunaris, and the internal oblique muscle. The third layer was the aponeurosis of the external oblique to Poupart's ligament. In Halsted's original operation the internal oblique muscle was divided, the veins removed, the cord transplanted into the upper angle of the internal oblique, and all the tissue below the cord were approximated beneath the cord, by a single row of heavy silk or silver wire mattress sutures.

If the conjoined tendon was weak, narrow or obliterated, the cord was isolated and transplanted, without division of the internal oblique muscle. Then a triangular flap of the anterior rectus sheath was made, turned down, and sutured to Poupart's ligament, making a new conjoined tendon. Then everything was closed as previously described, but beneath the cord, and the cord laid between the aponeurosis of the external oblique and the subcutaneous fat rather than between the aponeurosis and the next layer as in Bassini's method.

This imbricated suture in layers is credited to Edwin Andrews of Chicago. The modern operation by Halsted had,

therefore, become a composite or joint affair, but nevertheless, the principles originated by Halsted of the making and closing of a rent in the abdominal wall were maintained. When the conjoined tendon was obliterated, Halsted and Bassini's original idea of the value of the transplantation of the cord still held good. Apparently the cure of inguinal hernia was accomplished before the deaths of Halsted and Bassini, and other surgeons of their age, whose names are associated with this endeavor.

Recurrences today must be largely due to the operator's ignorance or carelessness in following the steps of the operation that experience has proved essential to success.

Halsted, therefore, lived to see, and I hope to enjoy, as his associates did, many of the operative procedures he was largely responsible for become fundamental and accepted, and it will be many years before Halsted's name is not mentioned with hernia and the complete operation for cancer of the breast.

### INTESTINAL SUTURE. SURGERY OF THE INTESTINES

Dr. Halsted was intensely interested in the details of intestinal suture from his experimental study in Welch's laboratory in 1886 up to his death. Most of his work was purely experimental. His original conceptions were practised chiefly on dogs, and most of them were successful. Unfortunately, when applied to man, they were not successful in Halsted's hands and very few of his associates practised his method of suture. When I visited Frederick Treves in London and we were discussing Halsted's intestinal suture, he remarked that this wonderful and original experimental work on dogs was, in his opinion, of no value for operations on man. When I told this to Halsted on my return I could see that his feelings were very much hurt. Nevertheless some ten years before his death, he voluntarily talked to me confidentially and expressed disappointment in his work both experimental and practical on intestinal suture.

I disagree with both Halsted and Treves. I am inclined to the opinion that as years go on more and more young operators will find Halsted's experimental work as reproduced in his Surgical Papers (vol. 1) fundamental, and not only the very best among the earliest studies, but still so at present. His descriptions and illustrations are characteristic of his originality and his attention to the gentle handling of tissue and the most perfect anatomical approximation. He was the first to emphasize the importance of catching the mucosa with the needle, to bring to the attention of the surgical world the fine straight needle threaded with fine black silk and sterilized for operation. Halsted presents the early literature on intestinal suture, but unfortunately fails to refer to Billroth's experimental and practical work on resection of the stomach for cancer. Billroth employed three rows of interrupted sutures of silk, the third row approximating the mucous membrane. The Billroth 1 operation, suturing the duodenum to the open end of the stomach, is undoubtedly the most difficult end-to-end anastomosis. When applied to the human gut, Halsted's one row of mattress sutures is insufficient. When two or three rows of mattress sutures are employed, too much is turned in. However, when one adopts Billroth's idea of three rows of interrupted sutures of the so-called Lembert type and Halsted's fine black silk threaded in his fine straight needle or the fine French curved needle, one has the most successful intestinal suture which will meet and overcome all difficulties no matter where it is applied. Halsted, as stated before, abhorred catgut and as far as I know, never used it in intestinal suture. We have, however, developed a perfect aseptic catgut which can be impregnated with chromic acid. The finer strands are strong. Catgut is now prepared threaded for continuous suture. It has its distinct place in intestinal suture, especially for the mucous membrane. Nevertheless, in my own experience, I still employ the fine black silk and needles of Halsted and usually the three rows of interrupted sutures of Billroth.

Now and then the specially prepared threaded catgut is used for the mucous membrane.

When Halsted was employing his method of suture

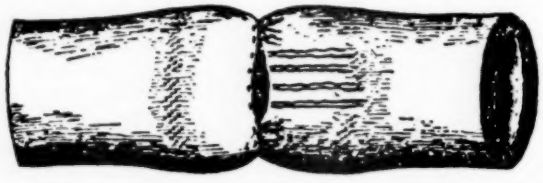

FIG. 10. Sketch of Halsted's end-to-end suture with single row of mattress or quilt stitches.

many surgeons were still using for an anastomosis Senn's decalcified bone plates, or rubber rings. During my student days at the University of Pennsylvania in Professor Reichert's physiological laboratory, with my classmate Hiller, we performed all types of intestinal anastomosis and suture, but never got beyond the rough methods of bone plates, rubber rings or potato rings. Then I knew nothing of the literature beyond Senn's experimental work. Murphy of Chicago, a man of most original mind and operative ability, was influenced by neither Billroth's nor Halsted's work on intestinal suture, but originated a substitute in his button, and for many years a number of operators preferred the button and feared the suture. Today intestinal suture is a pretty well-established and successful procedure, but I urge all who may read this to turn back and study Halsted's original work.

The most remarkable finding in Halsted's writings on suture of the intestine, from beginning to end, is his fear of soiling. As a matter of fact, judging from my experience on dogs and man, the danger of soiling during the operation is insignificant as compared with the danger of a leak from a faulty suture or obstruction from too much inversion in any anastomosis. Halsted emphasized from the very beginning the importance of not injuring in any way the circulation of the gut. Figure 10[1] demonstrates the single row of quilt or mattress sutures, Figure

[1] Fig. 21, vol. i, p. 205.

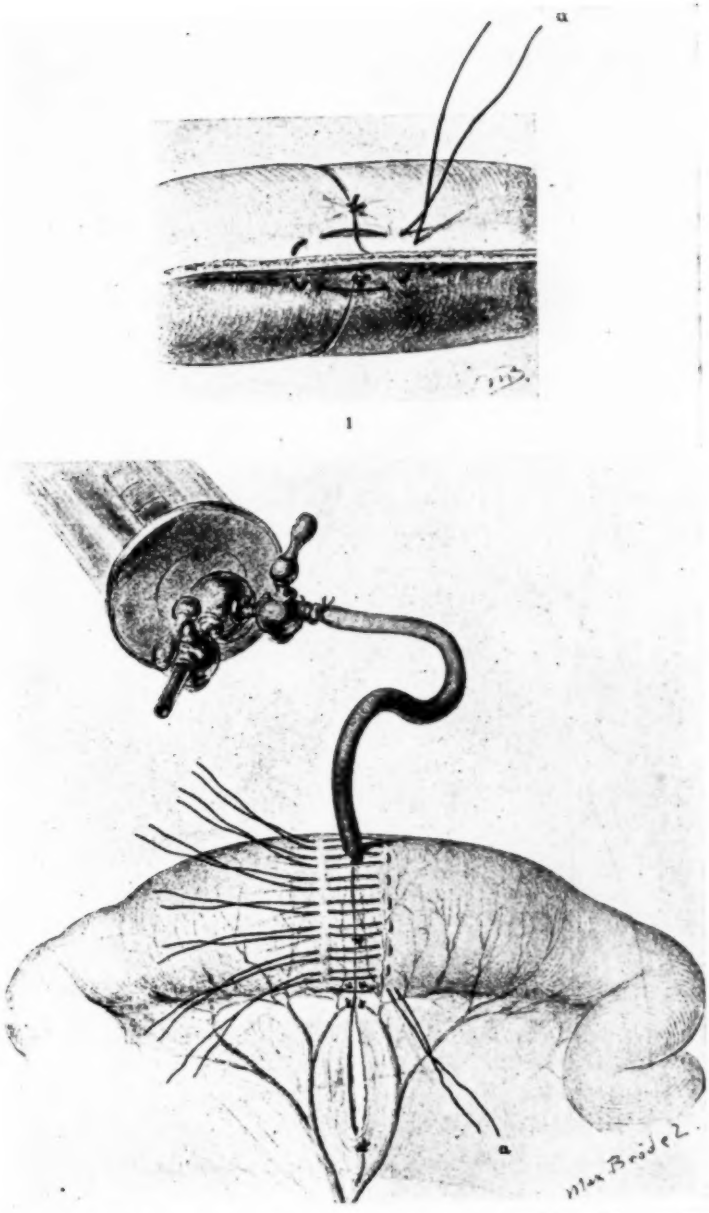

FIG. 11. Halsted's end-to-end anastomosis with inflatable rubber cylinder.

12[1] the method of a single row of mattress sutures applied to lateral anastomosis. Figure 11[2] shows Halsted's end-to-end anastomosis with an inflatable rubber cylinder. This method

FIG. 12. Halsted's method of lateral anastomosis with a single row of mattress sutures, the same as he employed in gastroenterostomy.

was presented to the medical society in 1897. I had the good fortune to employ it successfully in 1898 after resection of a piece of gangrenous ileum strangulated in the sac of an inguinal hernia. But even then I used three rows of interrupted fine black silk instead of one row of mattress sutures. Later Halsted developed his bulkhead sutures of the intestine that

[1] Fig. 25, p. 214.
[2] Pl. XI, 2.

may ultimately prove very important when we must resect the lower sigmoid and upper rectum. I always keep Halsted's instruments in the operating room for this procedure, but so far there has been no opportunity to employ them. The success of the new type of lateral sigmoid colostomy combined with appendicostomy has influenced me not to take the added risk of an attempt to restore the continuity of the bowel by end-to-end suture after resection of cancer in the lower sigmoid and upper rectum, but I look forward to the day when cases of this kind will come under observation with much smaller tumors and we will again consider restoration of the function of the bowel.

In conclusion I urge all surgeons not familiar with Halsted's work on intestinal suture to turn to the Surgical Papers (vol. 1) to study the illustrations most carefully and read minutely what he has written. Remember, that most of this was conceived and done more than forty years ago. It ranks therefore with the original work of Billroth which antedated Halsted's only a few years.

## HALSTED AS AN EVIDENCE OF THE VALUE OF THE SURGICAL SPECIALTIES

I am not writing this either to praise or to criticise Halsted, nor as I said in the introduction, as an historical paper. It has a definite purpose, an attempt to record as clearly and as briefly as possible the original conceptions and achievements of Halsted as an operator, a diagnostician, a surgical pathological, and a laboratory experimenter, and I have chosen those which in my opinion are still of fundamental value to members of the medical profession today, especially to the surgical group.

Halsted's achievement in resection of the stomach and colon and intestinal suture are evidence of the difficulty and perhaps the impossibility of a single individual being proficient in all departments of surgical diagnosis and intervention. When Halsted operated upon a lesion of the stomach or colon he was not as successful as in other fields. It may be difficult to

explain the cause but the fact remains true. All of his associates will agree with me, especially Finney, who without the training of the experimental work in the laboratory, almost immediately mastered the difficulties in the various operations upon the stomach, colon, and intestines, and his name will always remain as an originator of one of the fundamental operations upon the stomach and duodenum: Finney pyloroplasty. The impossibility, therefore, as illustrated by an individual of Halsted's mental character of becoming what we might call a great and universal general surgeon, is clear evidence that surgical specialities are a proper development in the evolutional progress of surgery. Every reader who has seen the great masters in surgery operate or attempt to operate outside of their special field will agree with this statement. I witnessed this in Vienna in 1893 when Billroth attempted to use Bigelow's apparatus to crush a large stone in the urinary bladder. I was also present at the autopsy next day. The rapid development from general surgery of such specialities as neurological and urological surgery and during the war, plastic surgery, is convincing evidence. William S. Halsted was a splendid example of the necessity of specialism if one wishes to be a master in the science and art of surgery. The same is becoming true of pathologists, especially in the newer demands of surgical pathology for diagnosis of frozen sections from tissue obtained in the operating room. No matter how expert one may be in the recognition of curettings from the uterus, or excised pieces of the cervix, this does not help much in the differentiation in the microscopic section of a benign from a malignant tumor of the breast, nor does the knowledge of the microscopic pathology of the breast help in the microscopic differential diagnosis of lesions of bone.

This difficulty of becoming an expert in diagnosis and therapy is becoming greater in spite of the better fundamental education before graduation in medicine and the larger opportunity in hospital clinics and scientific laboratories after graduation.

It is to be remembered that Halsted quoted Shuh, that it would be worth while to become a surgeon and devote an entire life to the service of discovering the operative cure of inguinal hernia.

### APPENDICITIS

It is unexplainable why Halsted has written so little about appendicitis. In his Surgical Papers there is but one reference, entitled A Diagnostic Sign of Appendicitis.* He presented a case to the medical society in 1893. The diagnostic sign is described by Halsted as follows: "When one can not press with the fingers into the false pelvis on the affected side so deeply as on the healthy side, in the earliest stages it is a spasm of the muscle which prevents one from dipping in the iliac fossa." He makes another interesting statement: "This muscle spasm may be partially or wholly eliminated by the proper application of the Paquelin cautery. When the patient is fully anesthetized no trace of the spasm remains."

It is to be borne in mind that at the opening of the Johns Hopkins Hospital in 1889 very few surgeons had had much experience with the diagnosis of appendicitis previous to the stage of abscess or peritonitis. When a case of appendicitis was fortunate to reach the stage of abscess without peritonitis, the drainage of the abscess was usually an insignificant affair, and the majority of surgeons made no search for the appendix. In the beginning peritonitis was a pretty hopeless affair, and when peritonitis came under observation earlier, recoveries were observed. Many surgeons concluded that the recoveries were due to their method of treatment, such as the Trendelenburg position or the Fowler position, or the giving of salt per rectum, when, as a matter of fact, the recovery depended upon the earliest stage of the general peritonitis, the type of organism, and the removal of the cause. In 1894 Halsted, after opening the abdomen, and revealing general peritonitis, placed the patient in a tub of water at the temperature of 100°

* Vol. 1, p. 222.

and in this way washed out the abdominal cavity. There were no recoveries, and there were no further attempts.

In my opinion Halsted's greatest contributions to the problem of appendicitis were, first, diagnostic, in the detection of muscle spasm; second, operative, in developing proper drainage for the local peritonitis and for walling off the infected area by iodoformized gauze. He writes:

> A point of great importance in the operative treatment of these cases and one to which we give perhaps an unusual amount of attention is the packing off of the uninfected portion of the abdominal cavity from the infected portion prior to the opening of the abscess however small this abscess may be. And even when we believe there is no abscess, we pack off the general cavity with just as much care prior to the separation of the adhesions which glue the cecum to the parietal peritoneum; and, in the absence of such adhesions, prior to the separation of the adhesions which bind down the appendix. Should pus be present, it is carefully caught and disposed of in such a way that there is perhaps the least possible danger of infecting the general peritoneal cavity. I fear that I can not well describe to you our method of packing off and protecting the general peritoneal cavity. We use a good many sponges of gauze superimposed upon each other in such a way that should the innermost become soiled the outermost remain clean. It is well if possible to so pack the outermost strips of gauze that they may remain undisturbed and form a part of the final packing of the wound.

It is interesting to note that this was written in December 1893, three and one-half years after the opening of the hospital, and Dr. Halsted mentions about 48 cases of appendicitis; 9 hopeless cases of peritonitis fatal; 5 of less desperate peritonitis with recovery; 34 cases of appendicitis without general peritonitis with recovery.

My memory tells me that Halsted was largely responsible for teaching us the diagnosis of the early stage of appendicitis and this method of drainage. Later it was difficult for us to teach our associates in the hospital how to drain in the late stages of appendicitis, because as the years passed drainage for acute appendicitis became a very rare occurrence. It is my opinion that Dr. James F. Mitchell of Washington who

followed Harvey Cushing as Halsted's resident surgeon, had the largest experience of us all during his residency in draining for the later stages of appendicitis, and I hope he will corroborate this statement of the great value of Halsted's ideas and practices in this drainage.

In addition to the best drainage, Halsted also had in mind an incision and a closure which would be best to prevent postoperative hernia. Halsted never adopted the McBurney method of muscle splitting. He either cut the lateral muscles directly, or split the rectus muscle. Nor did he adopt the Weir modification of McBurney's procedure nor the Lenander incision which went through the rectus sheath. Apparently this muscle division in the lateral muscles or splitting of the rectus made an abdominal wound just as good for drainage and better for the healing which would lower the percentage of postoperative herniae. Halsted also employed silver wire sutures through the entire thickness of the abdominal wall in cases in which there was drainage. My experience at that time and since assures me that this is an important safeguard procedure. It is not necessary in all cases. If there is any doubt it is better to employ it.

I feel under obligations to Halsted for his instruction in the early diagnosis of appendicitis, in the most successful drainage, and a closure of the wound that limited as much as possible the probability of a hernia.

I have already mentioned Halsted's fear, which was not founded on the facts, of the danger of leakage during intestinal suture. Halsted, on the whole, was a very venturesome surgeon, but he attempted in every way to reduce the risks of every operative procedure, an attitude that was not characteristic of the majority of the so-called great surgeons of his time. But Halsted also was timid in some regions and in some operative procedures, and it was very difficult to explain these occasional fears and unusual timidity. This was shown in the removal of appendices between attacks and in the earliest hours of an acute attack when there was no infection outside

the appendix. In those early days most surgeons removed the appendix after the method attributed to Nicolas Senn of Milwaukee. The vessels were ligated and the appendix was ligated near the cecum, leaving a short stump. The mucous membrane was touched with pure carbolic acid and scraped out with a knife. The peritoneum was protected with wet salt sponges. We did not know the value of alcohol then. Then Halsted drained to the stump in spite of the fact that he did not believe in drainage of other clean wounds. Recollect, in those early times there were very few operations for appendicitis in the interval or in the earliest stages when the peritoneum was clean. Finney was the first at Johns Hopkins to invert the stump of the appendix by a suture of the cecum and to close the wound without drainage. Later this method was adopted by Halsted.

### SURGERY OF THE BILIARY TRACTS AND THE PANCREAS

It was my good fortune to be associated with Halsted as resident surgeon in his department when he developed the principles of gall-bladder surgery—chiefly drainage of the infected gall bladder with or without stone and the removal of stone from the common duct and the handling of acute pancreatitis. Most of these problems were successfully worked out by Halsted with very little help from the literature. In this country up to 1896 and 1897 F. Lange of New York and Fenger of Chicago were perhaps giving the best and most attention to surgery of the gall bladder. Kehr was looked upon as the greatest authority in Germany. The Mayo brothers, Robson and Moynihan came into the picture later with the development of cholecystectomy.

Yet, Halsted contributed nothing until 1896 and then only a very short discussion of the remarkable paper by Lange delivered before the medical society at Johns Hopkins Hospital in October 1896. I remember very distinctly Lange's paper. He really gave in detail his personal experience, case by case,

and I was impressed with the fact of the great similarity with our experience at Johns Hopkins Hospital and how in many points there was agreement between Halsted and Lange. Halsted's remarks were very short; they had to be, because Lange's talk was very long. Halsted should have used this opportunity to rewrite the paper.

It is my conviction that Halsted's method of drainage of the gall bladder ranks first with the avoidance of postoperative hernia. Later postoperative hernia after drainage of the gall bladder became a very common occurrence, and even today I observe it after the simpler drainage when the gall bladder has been removed. Postoperative hernia after gall-bladder operations with drainage can be avoided just as certainly as in operations without drainage. It depends upon, first, the prevention of any leakage of bile and, second, upon the proper suture of the wound: strong silver wire passed through all the layers except the peritoneum meet the requirements best. The peritoneum can be closed separately and the layers of muscle and fascia can be neatly approximated separately, but it is far safer to add the through-and-through silver-wire sutures.

During my visit to Europe in 1892–1893 I made careful notes on the closure of all laparotomy wounds. At that time most of the abdominal surgery was performed for lesions of the pelvis. Among the leading gynecologists in every country in Europe very few depended upon catgut only. Most of them, in addition to the closure with buried sutures, reinforced with silkworm gut or heavy silk passed through and through and often tied on gauze plugs. Apparently they all feared, first, the breakdown of the abdominal wound with the evisceration of intestines, or, later, hernia. When I returned to this country I became familiar almost at once with the fact that those clinics which practised closure of the laparotomy wound with catgut only, even when chromicized, had a number of cases in which the wounds opened on the eighth to the fifteenth day, and to save the patients' lives the intestines had to be pushed back and the wound closed. There were some fatalities.

I record here again that in Halsted's clinic in which we followed his method of the closure of the abdominal wound there were no such occurrences. When there was no drainage Halsted, as in hernia operations, employed buried silk, later buried silver wire. When there was drainage, he used in addition silver wire through and through. There was a certain percentage of stitch sinuses before the employment of gloves, less with silver than with silk. But there were no early breakdowns of the wounds with evisceration of the intestines, no postoperative herniae after gall-bladder operations, and only a few, small, herniae in the drainage area after operations for appendicitis requiring drainage. The first laparotomy that I closed with catgut throughout in St. Agnes Hospital in about 1906 resulted in the breakdown of the wound on the fifteenth day. Fortunately I was present and the secondary suture with silver wire could be performed at once in the room of the patient. Later I had a similar case at Johns Hopkins Hospital. This has never occurred in my hands before or since. Of course, today our catgut is more dependable, but when wounds must be drained the additional precaution of silver wire passed through all tissues except the peritoneum seems to be a certain preventive and should not be neglected in special cases.

As far as I know this statement has never been recorded before. Later I may have an opportunity to give in detail the evidence of my claim that Halsted's original method of the closure of all abdominal wounds with or without drainage is still the best, although it may not be necessary in all cases.

In draining the gall bladder, Halsted sutured a rubber tube of good size into the gall bladder with silk and pulled the ends of the silk out of the wound. He then surrounded the tube and fundus of the gall bladder with iodoformized gauze, but the gauze entered the peritoneal cavity not more than 1 cm. The object was to prevent any leakage of bile into the peritoneal cavity or into the wound, and the tube and the gauze were left in place for more than ten days.

In the discussion of Lange's paper in October, 1896 Halsted speaks of three consecutive successful cases of incision into the common duct and removal of gallstones, but although this paper was read before the medical society it was never published. Halsted repeats here what he frequently told me: that he performed his first gallstone operation in 1880. This places Halsted as one of the first operators in this country to operate upon the gall bladder. He then discussed with Lange the question of drainage and the kind of drainage after removal of a stone from the common duct. He also cautions against the too early removal of the drainage. He advocates the suture of the duct after the removal of the stone and drainage to the suture rather than the introduction of the tube into the gall bladder. He speaks of the method of draining the gall bladder to prevent the leakage of bile which I have already discussed. He no longer followed Kehr's advice to operate upon the gall bladder in two stages.

It is interesting to record here a case in which Halsted was influenced by Kehr's advice to operate in two stages. I assisted him in 1894. It was a very easy simple case. The gall bladder was packed with a few large stones; there were no adhesions. Yet Halsted sutured the gall bladder to the peritoneum, packed down to this area and closed the wound. The wound healed so solidly that the stones could not be removed. For this reason Dr. Halsted sent the patient to Kehr. Kehr removed the stones and drained and later, for the first time Halsted operated upon a postoperative hernia in this region. It was this experience that influenced Halsted to be satisfied with his own technique, and it was the last operation for gallstones in two stages at Johns Hopkins Hospital.

The next contribution was in 1897 in which Halsted shows his great ingenuity in the conception of miniature hammers to aid in the suture of the common bile duct after the removal of a stone. Figure 13 portrays the hammer and its use. This method was ultimately given up. Further experience demonstrated the

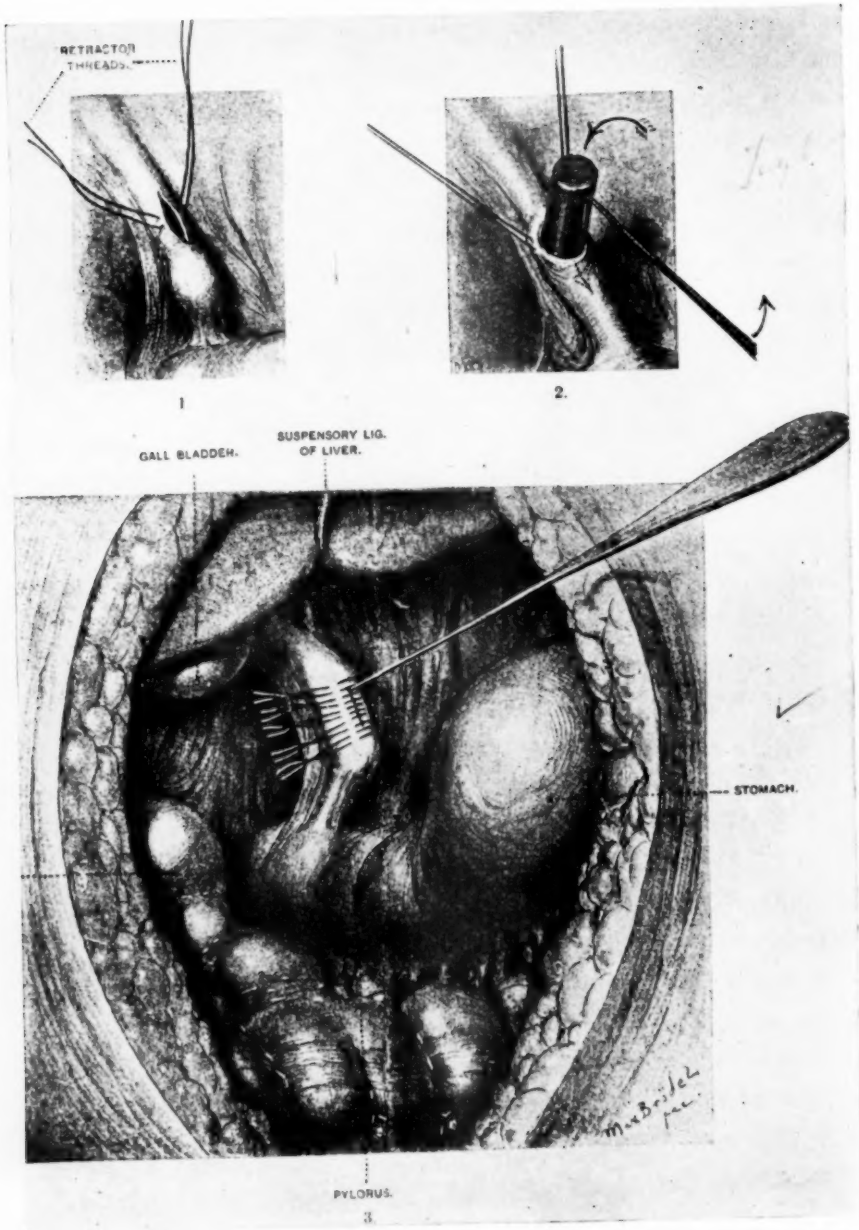


FIG. 13. The employment of the hammer in the closure of the common duct.

value of the drainage of the common duct after the removal of the stone.

One of the last contributions by Halsted to surgery of the common bile duct was the drainage of the duct through the end of the cystic duct after the removal of the gall bladder. This method reduces the danger of leakage of bile.

Halsted was one of the first to operate upon a case of acute hemorrhagic pancreatitis in which the patient recovered. This patient was seen by Dr. Osler in the examining room of the hospital in 1890. He had been ill three days with vomiting and abdominal distention. He looked so ill and cyanotic that Dr. Osler himself accompanied him to the operating room. The diagnosis was intestinal obstruction. Dr. Halsted opened the peritoneal cavity in the mid-line finally from ensiform to pubes. He evacuated large quantities of blood-stained fluid. There was no peritonitis and no obstruction, but in the omentum there were definite particles of fat necrosis. Apparently both Halsted and Osler were familiar with this rare disease which Fitz of Boston had described some years before. I saw an autopsy with Formad in Philadelphia in 1889 and then became familiar with hemorrhagic pancreatitis and fat necroses. Halsted left no personal note on this case, and he did not recollect whether he explored the pancreas and gall bladder. Finding no obstruction and only evidence of fat necrosis, both he and Osler looked upon the condition as hopeless. When Halsted closed the wound hurriedly he remarked that we would soon have an autopsy. This patient is employed as a painter in Johns Hopkins Hospital today. He has never had an attack since. He has never been overweight, nor confessed to overindulgence in alcohol.

From the very beginning Halsted was interested in the pancreas in relation to gall-bladder disease, familiarized himself most particularly with all the literature and with Dr. Opie's experimental work. Unfortunately Halsted's writings on the surgery of the biliary tract and pancreas do not picture his great knowledge of the subject, nor his pioneer position in the

diagnosis and operative treatment. His writings give a slight glimpse of his original conception.

I have already recorded my opinion that Halsted's method of drainage of the gall bladder and closure of the abdominal wound should be considered a fundamental contribution. The same is true of his exposure and opening of the common duct, or the exploration of the duct, of passing a large probe through the diverticulum of Vater into the duodenum, and, first, of the drainage of the duct into the common duct itself and later, after removal of the gall bladder, the drainage of the common through the cystic duct. Halsted was slow in adopting cholecystectomy, and the importance of drainage of the pancreas through a rent in the gastrocolic omentum. It is to be recorded here that the gall bladders encountered in the early years of Halsted's surgical experience would be dangerous gall bladders to remove today. It is remarkable how few of these extensively diseased gall bladders which were so thoroughly drained by Halsted gave any further trouble. It is quite possible that many of them never functioned again, and that the mucous membrane was so destroyed that Luschka's secreting glands were obliterated. I made a most careful study of the results of Halsted's operations upon the gall bladder and the common duct up to 1900. The mortality was very low and the recurrences after drainage of the gall bladder very few. In a few instances second operations were performed for a second stone left behind in the common duct. All other common duct cases recovering from operation remained well.

### SURGERY OF THE BLOOD VESSELS AND EXPERIMENTAL SURGERY OF THE LUNGS

Halsted has written more on this subject than on anything else. As he grew older, he gave more time to experimental surgery in the Hunterian laboratory and he devoted much attention to blood vessels, including aneurysms, intestinal suture and toxic goiter. In Volume 1 of his Surgical Papers 274 pages are devoted to blood vessel surgery, 152 to thyroid

problems. I can give no personal reminiscences of Halsted's experimental work on surgery of the blood vessels and surgery of the lungs. This came in a later period of his life. During my resident-surgeonship there was very little blood vessel surgery and there is only a single report. This operation, ligation of the first portion of the left subclavian artery and excision of a subclavial axillary aneurysm, was performed before I became a member of his clinic. However, I was present when Dr. Halsted presented this case. It was a very dramatic affair. Perhaps the most dramatic part was Welch's discussion. Halsted with his usual modesty, after presenting the patient fully recovered from the operation, left the room, and then Welch, whose remarks have not been preserved, spoke of Halsted as a surgeon in the very highest terms and how fortunate the Johns Hopkins Hospital was to have him as their chief surgeon. I do not believe Halsted ever performed a more difficult operation before or since. The aneurysm was huge. Halsted, however, was in his element, because the successful termination of the operation depended upon a slow, painstaking detailed procedure in which every bleeding point had to be tied. He could not aid himself by resecting the clavicle, because the aneurysm had eroded it, and there the sac was thin. Injury of the sac at that time would have meant death from hemorrhage. Finally, when the left subclavian artery was exposed it was entirely concealed by the subclavian vein. However, the operator, fully trained in this difficult procedure and familiar with the anatomy, succeeded in passing two silk ligatures to the artery as it emerged from the chest and divided the artery between the ligatures. This made the rest easy. The complete operation required three and one-half hours. Halsted writes: "This case is perhaps the only successful one of the ligation of the first portion of either subclavian artery and the first complete extirpation of the subclavio-axillary aneurysm. The patient lived many years."

Dr. Matas is one of the few living surgeons today who can really appreciate this great achievement of Halsted in 1892,

and also Dr. Matas is one of the few surgeons who can truly estimate Halsted's great contributions to surgery of the blood vessels.

### SURGERY OF THE THYROID, PARATHYROID AND THYMUS GLANDS

These studies of Halsted began with experimental work in Welch's laboratory, and his contributions to this subject in pages rank second to his contributions to surgery of the blood vessels. In the beginning Dr. Halsted's experimental work in the laboratory before the opening of the hospital in 1889 was chiefly on intestinal suture and the thyroid. He continued his intestinal suture experimentation throughout life, later taking up blood vessel surgery. However, he never lost his interest in the thyroid, parathyroids and thymus. During my resident-surgeonship our time was so largely taken up with operative problems and, in the beginning of 1895, with teaching, that Dr. Halsted temporarily dropped his experimental work in the laboratory. In addition, the pathological laboratory became so crowded with special pathologists that there was practically no opportunity for experimental surgery, and when the Hunterian Laboratory was opened for Cushing and McCallum, Halsted had for the second time an opportunity for what he enjoyed most—experimental surgery. For this reason I can not speak personally of the experimental work even in later years. I assisted Dr. Halsted in all his early operations on the thyroid gland. The majority of the lesions of the thyroid were non-toxic goiters, cysts and adenomas. These offered no complications whatever, and Halsted's experience in axillary dissection prepared him for the most perfect attack on non-toxic goiters. This led to the development of a technique which was comparatively slow. During my period with Halsted there were not many toxic goiter cases and all of them were bad operative risks.

Halsted's experimental work ranks him with the first and best in developing our knowledge of the thyroid, parathyroids and thymus glands. The development of his technique for the

operation on toxic goiter came later when there were many others in the field.

### HALSTED AS A PATHOLOGIST

Fortunately I had had the previous training and experience to appreciate Halsted as a pathologist. Because of this he gave me the great opportunity of taking charge of the pathological material from his operating room, of recording and studying it in a special room assigned to surgical pathology in Professor Welch's laboratory. When a student at the University of Wisconsin in 1886 I dined with Dr. Mackey in Milwaukee. After dinner he took me to his office and I witnessed him make a frozen section from a breast tumor removed by Nicholas Senn that morning. Mackey remarked, after cutting and staining the section: "I told Senn it was cancer," and added: "Fortunately, we did the complete operation." Mackey was educated in Edinburgh. It was the first frozen section I ever saw made, although I was quite familiar with the methods of making permanent sections, as I was taking a course of histology and embryology at the university. Later I witnessed Senn perform the complete operation for cancer of the breast which represented the most complete performed at that time. The muscles were not removed, the axilla was fairly well dissected out, the margin of skin given the visible and palpable tumor was small. The wound was closed without skin grafting. I soon learned that Mackey and Senn were good gross pathologists. Although Mackey's name does not appear, he aided Senn very much in the writing of his book on surgical pathology. Frozen sections were not made in the operating room.

In Philadelphia our greatest teacher of pathology was Formad and a few of us had great opportunities to familiarize ourselves with gross pathology from his autopsies. The professor of gynecology at the University of Pennsylvania always presented to special students of Formad the tumors of the ovaries and uterus which he removed at his weekly clinic.

The next week we presented before the class the microscopic reports from Formad's laboratory. In the majority of instances Dr. Goodell was right in his gross pathological diagnosis. He was the third surgical pathologist with whom I became acquainted. During my internship at the Children's Hospital in Philadelphia between 1891 and 1892 there were a great many autopsies on children.

I did not appreciate Halsted's remarkable pathological knowledge until I had returned from my extensive visits to European clinics. When I visited Vienna Billroth was living and engaged in active work and von Eiselsberg was his first assistant. Unfortunately I did not come in close enough contact with them to learn that Billroth was one of the great surgical pathologists.

I remember distinctly, and the records in the surgical pathological laboratory are evidence of these statements, that Halsted made very few mistakes in his gross pathological diagnosis at the operation. During my close association with him for seven years, we never used the frozen section to help us in the operating room. I had brought back from Europe a frozen section microtome and was familiar with making and staining the sections. This allowed us to see the sections more quickly after the operation to satisfy our curiosity, because then it took longer to get permanent sections. It is recorded in one of the surgical histories in 1891 that Dr. Halsted, after removing what he considered a benign tumor of the breast, sent it by an orderly to Dr. Welch in his pathological laboratory, some five minutes' walk away from the operating room. About three-quarters of an hour later Dr. Welch came to the operating room to tell Dr. Halsted that the section showed a benign tumor of the breast. But Halsted had already decided this from the gross appearances and had finished the operation and returned to his home before his colleague Dr. Welch had reached the operating room.

The first breast tumor that Dr. Halsted failed to recognize as malignant was a smooth-walled, thick-walled cyst contain-

ing blood. There was no evidence of a papilloma and no thick grumous material. It was the first blood cyst that Dr. Halsted had encountered in the breast, and no one then knew that such cysts are always malignant. We could not see any evidence of cancer in the wall. The malignancy was found a few days later in the section. The next blood cyst was recognized as malignant by Dr. Halsted. As long as Dr. Halsted lived and operated upon any case in which malignancy had to be considered, he retained his keenness of gross pathological diagnosis. There is also another evidence of his unusual training for the naked-eye appearance of pathological conditions, especially in the breast. During the first ten years of the experience in his clinic there were a few cases in which the breast tumor was clinically benign and when explored did not have the appearance of cancer of the breast with which Dr. Halsted was familiar. Therefore only the tumor was removed. Later, after careful microscopic study it was decided that the tumor was or might be malignant, and the complete operation followed. We now know that these tumors are not cancer and that Dr. Halsted's gross diagnosis of benignancy was correct, while the microscopic conclusion of malignancy was incorrect. Velpeau's experience confirms this. The first volume of Velpeau's book on diseases of the breast was written entirely on gross pathological diagnoses. In the second edition he complained that the microscope had led to many confusions. He did not realize, at least he did not comment upon the fact, that the individuals making the microscopic diagnosis were inexperienced, while he, Velpeau, had reached the zenith of gross pathological interpretation. Consequently Velpeau's microscopists frequently differed from Velpeau and the latter claimed that he was right. More than half a century later Dr. William H. Welch in a visit throughout this country was frequently called in consultation by operators who were good gross pathologists, because the less experienced microscopic pathologists found areas of malignancy in the myomas of the uterus which they had removed by hysterectomy; and the pathol-

ogist showed a tendency to diagnose encapsulated breast tumors and routine curettings from the uterus as malignant. In this personal communication to me Welch expressed the opinion that the experienced surgeons were always right.

We are approaching the period today when this great pathological knowledge and keen ability to distinguish the benign from the malignant at the exploratory operation is of fading value. The enlightened individual, due to modern educational methods, comes under observation in a much earlier stage of the disease, and until we have discovered a laboratory test, as for example a differential stain between the cell that is not cancer and the cell that is positive diagnosis is not always possible. Cancer has become a microscopic disease. If this generation can become just as proficient in the microscopic differentiation of diseases exposed in the operating room by the knife, as Halsted and the great surgical pathologists beginning with Velpeau were expert in the recognition of benign and malignant conditions by their naked-eye appearance, there will be very few mistakes of incomplete operations for malignancy when the lesion is operable or complete operations for non-malignant local growths. Apparently it is more difficult for an operator to be proficient in the operative technique and in microscopic diagnosis than it was for the operator to be proficient both in the operation and the naked-eye recognition of pathological conditions exposed during the operation or brought to view after removal of the mass. It may be ultimately just as necessary to have a trained special pathologist in the operating room as a surgical assistant, or an anesthetist, or someone trained to give blood transfusions when indicated.

## CONCLUSIONS

In conclusion, I have attempted, largely from memory, but with Halsted's publications before me, to picture briefly Halsted's knowledge of the principles of surgery at about the time of 1894 or 1895, when I had had two years' experience

with him in the Johns Hopkins Hospital as his resident surgeon. For at least five years I assisted him as first assistant, made rounds with him, and became familiar with his diagnostic ability. Osler told me that Halsted was the best read of any member of the faculty. I soon learned that this reading was largely of German literature and at that time and for some years later it undoubtedly was the best surgical literature. The atmosphere of Johns Hopkins Hospital was strikingly different from anything in this country at that time. The four clinical professors were on comparatively large salaries. Their private practice, in the beginning, outside the hospital, was relatively insignificant. Although we were very busy, no one was hurried. I do not remember how Dr. Halsted got to the hospital. Frequently I rode in street cars to and from the hospital with Osler and Welch, or with Kelly in his open victoria and two horses. Halsted did drive a most disreputable looking horse and buggy, a great contrast with his equipment five years later when he had a liveried coachman, a cob horse and a most striking closed coupé. But this transportation was also very leisurely.

As an example of life in those early years, I may briefly tell this story:

In 1893 we were treating tuberculosis of the joints with injections of iodoform. About once a month, on Saturday afternoons at about half past two or three, Halsted called at the hospital with his very countrified horse and buggy, and we took the necessary things for anesthesia and the freshly boiled instruments and sterile towels wrapped in sterile sheets and packed them in the back of the buggy. The latter was rather dusty. We then drove slowly about ten miles to the country place of a Baltimore lawyer whose daughter had tuberculosis of the hip. I anesthetized the young girl and Halsted cleansed his hands and the area on the hip. I then unfolded the sterile sheet and Halsted picked up the hypodermic syringe which had been filled with the oil emulsion of iodoform and gave the injection. We rarely returned home before seven o'clock.

This procedure took more time than six or eight operations in the morning. It was a great intellectual treat for me, because I made it a point to ask Halsted questions every second, coming and going, and in those precious half days I was told in the most interesting way the entire history of Halsted's surgical work in New York and about all the New York surgeons. In addition, I learned the names of all the German surgeons connected with German universities and about their work. He also familiarized me with the great clinic in Vienna. The knowledge gained then was of the greatest value to me and put me in the position to realize Halsted's intellect and originality, and his unusually keen knowledge of medical and surgical affairs throughout the world. Later on life became more complicated and occasions of this kind less and less frequent.

I hope that some day I may write an appreciation of William Stewart Halsted which will somewhat approach the heights of the appreciation written by Rudolph Matas as an introduction to the Surgical Papers of Halsted. Dr. Matas tells us that his real familiarity with Halsted and his surgical knowledge did not begin until 1903. Therefore I have attempted here in a most brief way to describe those achievements of Halsted which are fundamental today and should be as valuable to the intern and young surgeon as they were to Halsted and his group of trained surgeons.

# HYPERTROPHIC TUBERCULOSIS OF THE ILEUM WITH MULTIPLE LESIONS

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TUBERCULOUS enteritis, while not in itself a very rare disease, is usually invested with more medical than surgical interest. In its commonest form, ulcerative enterocolitis, it is a frequent concomitant of advanced puls monary tuberculosis. Its incidence under such circumstance- is variously placed at from 52 to 90 per cent, as based upon autopsy findings, in the reports of different authors. Rarely, if ever, is it a primary lesion in adults; almost universally it is considered secondary to some pulmonary, or possibly laryngeal focus. It is most common in children and young adults, various ages reported ranging from three to seventy-one years. The greatest incidence, however, seems to be between twenty and thirty years. It frequently affects the large bowel in the region of the cecum and ileocecal valve, although it may extend throughout its length.

When present in the small bowel, the terminal 4 feet of ileum are most often affected. Here lymphoid tissue is most abundant. It is rare to find the ulcerative process confined to the small intestine alone. The case which we report is of this type of which very few instances have been recorded to date.

Tuberculous lesions of the intestine are thought by some observers to be dependent upon (1) a blood-borne infection; (2) an implanted infection, from swallowed organisms; and (3) an extension from mesenteric glandular involvement. (The latter would seem to be rather a reversal of the expected progression.) The most likely etiological explanation seems to be the passage of the tubercle bacillus through the bowel

mucosa (which need not have been previously injured or diseased to furnish a portal of entry) into the lymphoid tissue in the submucosal layer of the bowel wall. Here the usual reaction of the tissues, which we recognize grossly and microscopically as tubercle formation, takes place, followed later by ulceration of the mucosal layer. Rarely does this process extend outwards into the muscularis and serosa, hence these tuberculous ulcers rarely, if ever, perforate the bowel wall. In some instances, where the individual's resistance is great enough, or the infection sufficiently attenuated, an attempt at repair is made. It is then that tuberculosis of the intestinal tract begins to assume surgical significance. To be sure, some surgeons have advocated certain procedures for the relief or cure of certain distressing symptoms of the disease, e.g. diarrhea, hemorrhage, obstruction, etc. Resection of the ulcer-bearing bowel has been proposed. Unfortunately the condition is usually too widespread and the patient in too bad condition physically, to stand an extensive operation. Loop exclusion, in order to give rest and a chance to heal, appeals to some, but the same objections hold, though to a less degree. With the advance in knowledge concerning the use of natural or artificial sunlight in the treatment of all types of tuberculous lesions, the need for surgery seems to grow less and less, until now it would seem that operation is rarely indicated in the purely ulcerative stage of tuberculous enteritis.

Coincident with the attempt at healing, one of two things may happen: (1) either a marked hypertrophy of the bowel wall, to the extent even of encroachment upon, or complete blockage of, the intestinal lumen, the so-called hypertrophic type; or (2), a gradual contraction of the fibrous scar tissue, with diminution of the lumen of greater or lesser extent, the so-called stricture forming type. The liability to repair-tissue overgrowth seems to be in inverse ratio to the virulence of the organism and to the degree of infection. Just as the ulcer-bearing area is usually in or near the ileocecal valve, so is this

the commonest area for hypertrophic manifestations and stricture formation.

With the encroachment upon the bowel lumen advancing to the point of partial obstruction, we have laid the foundation of a true surgical condition. While a few authors take the extreme position that no intestinal tuberculosis is rightly treated by surgery, that even the obstructing, hypertrophic types yield to efficient "light" treatment, there is almost universal agreement that here operation is justifiable, indeed, indicated. Especially would this seem to be the case, since admittedly, the hypertrophic type usually occurs in cases where there is either a mild pulmonary involvement, or one which appears to have been completely arrested.

The symptomatology of hypertrophic intestinal tuberculosis is that of any chronic partial intestinal obstruction, plus a definite or suspicious tuberculous infection. There is nothing characteristic enough to warrant positive differential diagnosis, but in a relatively large number of instances, a careful history will direct suspicion in this direction.

The operative procedure should in every instance be determined by the conditions encountered after the abdomen has been opened, taking into consideration the general physical condition of the patient.

The case which we report is of more than ordinary interest, and quite unique, in that a second resection of the ileum had to be made after a short interval, due to a rapid recurrence of the process. It was of the hypertrophic type, confined entirely to the ileum. Counseller states that only seven cases of this type had been reported in the literature up to 1929, though we have been able to find a few additional. There were multiple lesions present, two of which seemed to be of rather rapid development. There were two separate operations required, each with resection of involved loops of bowel. Other interesting points were the family background of tuberculosis, one brother and one sister having died of this disease, and the patient himself exhibiting signs of healed apical lesions,

though with a *negative* tuberculin reaction; the onset of symptoms following immediately upon a previous operation, performed elsewhere, for acute appendicitis; the course of the disease while under our own observation; and the excellent recovery, and satisfactory present condition, after eighteen months.

The case report follows:

Mr. J. L. C. C., male, white, aged forty-six years. Admitted to Union Memorial Hospital, Baltimore, January 9, 1929. Discharged May 2, 1929. Complaint: Periodic pain in left lower abdomen.

Family History: Father died at sixty-two, of diabetes; mother died at seventy-two, suddenly, cause unknown; one brother died at forty, and one sister at twenty-one, of tuberculosis; one sister died at thirty-nine, of erysipelas. Three sisters are alive and well at forty-four, fifty-two and fifty-four, respectively.

Marital: Married seventeen years. Wife alive and well at thirty-eight. One miscarriage, at three months, about fifteen years ago. One son alive and well at sixteen. No other pregnancies.

Occupation: Manager of a chemical plant, where ammonia and wood alcohol are made. Little exposure to fumes, however.

Past History: General health good. Childhood diseases. At eighteen years an attack of jaundice which lasted about ten days. In 1926, following loss of weight of 10 pounds, was subjected to period of biliary drainage by duodenal tube; weight regained following this. In October, 1928, appendectomy for acute appendicitis, with good recovery.

Review of Systems: Head, eyes, ears, nose and mouth negative. Cardio-respiratory: negative. Gastrointestinal: always poor appetite. Chronic constipation for seventeen years, for which a mild cathartic is taken each night. Genitourinary: negative. Nervous: negative. Skeletal: negative. Present weight 120 lbs. Normal about 140 lbs. Habits: Fairly regular meals, though small eater. Moderate use of tobacco and alcohol.

Present Illness: Ten days after leaving hospital following appendectomy, developed intermittent sharp, shooting pains in lower left abdomen, usually accompanied by nausea and vomiting. This was aggravated by nervous strain or exercise. The attacks have become gradually more severe and frequent, since the onset. They occur almost always in the evening or early night. Vomiting usually furnishes some relief from the pain. The attacks do not seem to come at any regular intervals, or to be induced by any particular thing. There has been no noticeable increase in the degree of chronic constipation, no periods of diarrhea, no abnormalities noted in the stools. There has been gradual progressive loss of weight.

Physical Examination: Rather markedly undernourished man, lying comfortably in bed. Skin sallow; no petechiae or eruptions. Mucous membranes fair color. No gross abnormalities. Bones and Joints: seem normal. Glands: anterior cervical groups moderately enlarged, epitrochlears not felt. Reflexes: present, active and equal. No Babinski reaction or clonus. Head: normal contour. No sinus or mastoid tenderness. Ears: normal. Eyes: pupils equal, regular. React to light and accommodation. Extraocular movements good. Ophthalmoscopic: normal. Nose: negative. Mouth: mucous membranes rather pale. Upper teeth gone. Remaining lowers show marked pyorrhea and are devitalized. Tonsils and Pharynx: negative. Neck: negative. Thyroid not enlarged. Thorax: symmetrical. Deep supraclavicular fossae. Respiratory excursions normal. Lungs: percussion note moderately impaired at both apices, to level of second vertebral spine behind. Prolongation of expiration, with increased intensity of whispered sounds over this area. No râles heard. Heart: apex in fifth interspace, inside the nipple line. Regular in force, rate and rhythm. No shocks or thrills. No murmurs heard. Blood-pressure 102/70. Radial arteries moderately thickened; radial pulse equal. Abdomen: symmetrical; rather scaphoid. Old well-healed McBurney scar. Respiratory excursions normal. No visible peristalsis. Liver not enlarged. Spleen and kidneys not felt. No acute tenderness anywhere. No masses felt. Percussion note normal. No borborigmus. Genitalia: normal. Rectal: negative. Impression: (1) Gastrointestinal neurosis with spastic colon. (2) Malnutrition. (3) Old fibroid tuberculosis at both apices.

Laboratory Examinations: Urine: specific gravity 1.010. Reaction: acid. Albumin: trace. Sugar: negative. Acetone: negative. Bile: negative. Microscopic: occasional hyaline cast and white blood corpuscle. Many urates. Stool (numerous examinations): little mucus. soft, dark brown, normal appearing. Occult blood usually present, though never marked. No gross blood. Bile present. Microscopic: negative. Blood: W.B.C. 13,300. P.M.N. 76 per cent. Lymphocytes 34 per cent. No abnormal cells. R.B.C. 3,830,000. Hemoglobin 75 per cent. Wassermann reaction: negative. Blood grouping IV. Chemistry: N.P.N. 17.6 mg. Sugar 93 mg. Gastric Analysis: Ewald meal: 112 c.c. recovered after forty-five minutes. Bile stained. Free HCl. 30. Total acidity 55. No occult blood. Microscopic: negative. Basal metabolic reading: −1. *X*-rays: bismuth enema. Entire colon filled except the cecum. Marked spasm of entire tract. Teeth: Marked pyorrhea. No abscesses. G.I. Series: Cow-horn stomach. Normal size. Good motility. No obstruction. Duodenal cap normal. No evidence of any lesion in stomach or duodenum. Colon prolapsed. Filled with barium in twelve-hour plate.

Progress Notes: January 10, 1929: This afternoon the patient had an attack of sharp, cramping pain in left lower quadrant. During the height of the pain, his face was drawn, and his body in a profuse cold perspiration. The entire abdomen was quite tense, most marked in left lower quadrant. There was little tenderness, and this not localized. Some complaint of nausea, but no vomiting. No visible peristalsis. Patient obtained almost immediate relief from benzyl benzoate dram 1. January 11: There was another attack of pain early this morning, which was partially relieved by self-induced vomiting, small amount. A return about noon was again controlled by benzyl benzoate. January 15: No further pain or discomfort during past four days. Patient sitting up. Appetite fair. Stools contain occult blood. January 16: Tuberculin test: 0.1 c.c. old tuberculin controlled with normal salt. January 20: Tuberculin test entirely negative. Patient continues to feel very well. Up and walking around. January 24: All remaining lower teeth were extracted this morning, at dentist's office, after mandibular injection. No reaction. January 26: For several hours this afternoon has had general discomfort, with some pain in left lower quadrant. Nothing very acute, however. This evening vomited 900 c.c. of greenish fermented fluid, without much relief of discomfort. January 27: During past twenty-four hours has vomited several times, a total of 2600 c.c. of fluid as above. Is feeling much better this evening. January 30: Comfortable for past three days. February 3: Has been having more discomfort for past forty-eight hours. Some nausea, but no vomiting until this evening, when there were 1800 c.c. of undigested food, at one time. Discomfort almost entirely relieved. February 6: Some abdominal pain and discomfort since last evening. This morning again vomited 1800 c.c., at one time, but without complete relief. February 7: Vomited 900 c.c. last night. Although nothing definite can be made out, and the patient gets along perfectly well in the intervals between attacks, it seems that there must be some organic obstruction somewhere. It is therefore deemed advisable to perform an exploratory operation.

First Operation: February 9, 1929. A thorough exploration was done through a mid-right rectus incision. The stomach and duodenum were normal in every respect. The gall-bladder was thin walled, blue, emptied readily; no stones were felt. Kidneys and spleen were normal to palpation. The colon was normal throughout, no constrictions or kinking. There were no particular adhesions in region of previous appendectomy. In the small intestine, about the junction of the jejunum and ileum, was an indurated area, about 2 inches in extent, practically completely surrounding the bowel, and markedly constricting the lumen. The peritoneum overlying this area was covered with enlarged lymphatics, no typical tubercle formation. The intestine was somewhat dilated for a short distance above the

mass. There were a few enlarged mesenteric glands. An 8 inch loop of intestine was resected, together with a wedge of mesentery containing the enlarged glands. A typical end-to-end anastomosis was performed, in two layers, the inner of plain catgut, the outer of silk. Wound closure, in layers, with catgut, and without drainage.

Postoperative Diagnosis: Indurated ulcer of small bowel, probably tuberculous.

Postoperative Progress Notes: February 9: Patient returned from operating room in good condition. Some nausea and vomiting. February 14: Course smooth and uneventful, except patient has required catheterization ever since operation until today, when he voided twice. Is taking soft nourishment and fluids well. No further nausea or vomiting since day after operation. February 21: Excellent progress during past week. A small abscess in the abdominal wound was opened this morning; contained small amount of typical colon bacillus pus. This evening patient complained of some abdominal cramps. This was accompanied by considerable nausea, and vomited a small amount of bile-stained mucus twice. Patient exceedingly apprehensive, due to similarity of this occurrence to that which followed his appendectomy. February 27: Wound well healed, infection cleared up. No further abdominal discomfort until this evening, when there was a recurrence of mild cramps across lower abdomen, with some nausea. Vomited once, undigested food. Bowels moving well. March 4: Fairly comfortable for several days until today, when there were rather severe abdominal cramps, some distention and borborigmus, nausea and vomiting. Patient very depressed mentally. March 9: For past several days patient has had intermittent vomiting attacks, bringing up as much as 800 c.c. at a time. Last night and today particularly uncomfortable with cramps across lower abdomen and pain through to back. March 11: Another very severe attack today, with much vomiting. For the first time there was definite visible peristalsis across lower abdomen, chiefly to left of midline and below umbilicus. Everything by mouth discontinued, infusion normal salt 2000 c.c., foot of bed elevated 6 inches, and hot stupes to abdomen. March 12: Much more comfortable, but slight elevation of temperature, $100^2$ this evening. March 14: Attack has subsided, looks and feels much better. Temperature normal. No nausea. To have abdominal massage every other day. March 22: Excellent progress, up and around and on regular light diet again. Occasional slight cramps and nausea following massage, otherwise perfectly comfortable. Last night vomited undigested food twice. March 28: Still occasional twinges of pain across lower abdomen and through to back. Abdomen soft, no distention or tenderness. No further nausea or vomiting. April 4: Severe attack of cramps yesterday and today, accompanied by marked nausea and frequent vomiting, at

times as much as 1000 c.c. of bile-stained fluid, suggestive of duodenal contents. This afternoon there is again definite visible peristalsis, though an enema was fairly effectual, both as to flatus and fecal matter. April 8: Mild cramps and nausea at times. No more vomiting or visible peristalsis. Bowels moving adequately. April 11: Another severe attack of cramps, nausea and copious vomiting, and again visible peristalsis across lower abdomen. It was felt that there must be some intermittent partial obstruction, probably due to adhesions, or contraction of the previous anastomosis. An exploratory operation seemed to be indicated.

Second Operation: April 13, 1929: Old scar excised, and abdomen opened. There are a few adhesions of small bowel to under surface of scar; these were separated. Site of previous anastomosis is perfectly healed. There are two separate masses in the lower ileum, about 6 inches apart, with dilated loops of bowel above, and collapsed bowel below. The lower constriction is about 4 inches above the ileocecal valve, which appears to be normal. The peritoneum of the bowel over the masses is studded with typical small tubercles, and there are many enlarged mesenteric glands. Both large and small bowel elsewhere appears normal. No enlarged glands retroperitoneally along aorta; unable to find with certainty the site of the first anastomosis. The healing was so perfect. Resection of about 12 inches of bowel, down to within 2 inches of ileocecal valve, was performed. The stump was then inverted, and a typical lateral anastomosis, ileum to cecum, performed. The wound was closed with catgut and silkworm gut, through and through stay sutures, without drainage.

Postoperative Diagnosis: Hypertrophic tuberculous constrictions, small bowel.

Postoperative Progress Notes: April 13: Patient returned from operating room in fair condition, moderately shocked. April 18: Progress excellent. No nausea or vomiting. Liquid diet. April 24: Patient making rapid, uneventful recovery. Wound well healed, all stitches removed. No infection. Is taking soft diet. Bowels moving well.

Discharge Note: May 2: Patient has made a remarkably rapid and uneventful recovery since last operation. No abdominal discomfort whatever. Wound solidly healed. On general light diet. Has been up walking around for several days and is rapidly regaining his strength. Weight is now back to within seven pounds of that on admission.

Follow-up: We have had several communications from the patient since leaving the hospital, all reporting satisfactory progress. He returned to work about six weeks after leaving the hospital, and has been leading a very active life ever since. He has regained his normal weight. Is keeping

out of doors as much as possible and taking systematic "sun baths." Now, after seventeen months, he feels perfectly well in every way.

Comment: There are a number of most interesting angles to this case, which furnish considerable food for thought. The patient was a nervous, rather high-strung individual. The complaints at first greatly outweighed any tangible objective signs or symptoms of organic disease. He was considered by his attending physician neurotic. There was the utter failure of all "special" examinations, except occult blood in the stools, to throw any light on the condition; *x*-rays, blood counts and chemistry, differential count, tuberculin reaction were all negative, hence the difficulty in making a diagnosis. The question arises as to the duration of the lesion; was it present at the time of the appendectomy in 1928? If so, was the appendix tuberculous? These questions cannot be answered as the operation was done elsewhere, and the specimen was not examined. Were all three lesions present from the beginning? Did the trouble in the lower ileum, found at our second operation, develop after our first operation? The latter would appear to be the case, as a thorough and careful exploration was made at the time of our first operation, and a note made as to negative findings. Such an examination should have revealed a pathological area in the bowel at the point where it was subsequently found, had one existed at the time. If it was not present at the first operation, it was quite remarkable that it should suddenly light up and develop with such rapidity, without any appreciable change in his general condition, or other evidence of renewed activity of his known, arrested pulmonary lesion. This case constitutes a very definite justification of the use of surgery in properly selected cases, and would also appear to furnish a refutation of the claims of those who take the extreme view that surgery has no place in the treatment of tuberculosis of the intestines.

Pathological report by Dr. Cohn: "In the gross we have a piece of ileum about 9 inches in length, much distended. On the peritoneal side we can see the constriction which extends almost around the bowel. It is

covered with a good deal of fibrous exudate. The wall of the ileum is considerably thickened. When we look at the mucous membrane side we can see that the lesion encircles the wall of the bowel and produces almost complete obstruction. The constriction is composed of a good deal of scar tissue and covered with mucous membrane, with here and there a minute ulcer. In the frozen section we can see a more or less normal mucosa, then an ulcer which is quite vascular and the base of the ulcer contains granulation tissue; in the granulation tissue we see a great many giant cells of the tuberculosis type, a tubercle formation with central giant cells, nothing suggesting malignancy."

## BIBLIOGRAPHY


1. Archibald, E. W. *Am. Rev. Tuberc.*, 1: 449, (Oct.) 1917.
2. *Canadian M. A. J.*, 10: 804, (Sept.) 1920.
3. Bernay, C. Les sténoses tuberculoses de l'intestin grêle. Lyon, 1899.
4. Bessesen, A. N., Jr. *Am. J. Surg.*, 38: 233, 1924.
5. Bevan, A. D. *Surg. Clin.*, 3: 75, 1919.
6. Biard, R. Des tuberculoses hypertrophiques associées du caecum et de l'intestin grêle. Paris, 1925.
7. Borchgrevink, O. *Norsk Mag. f. Laegevidensk*, 13: 57, 1898.
8. Bottaro, L. D., and Dominguez, C. M. *An. d. Fac. d. Med. Montevideo*, 12: 397, 1927.
9. Brown, R. O. *Southwest. Med.*, 7: 65, (March) 1923.
10. Brown, L., Sampson, H. L. and Hayes, J. N. *Trans. Nat. Tuberc. Ass.*, 18th ann. meet., p. 343, 1922.
11. Brüning, F. *Deutsch. med. Wchnschr.*, 45: 1105, 1919.
12. Buckley, R. C. *U. S. Vet. Bur. Med. Bull.*, 3: 929, 1927.
13. Carlsson, *Hygeia*, Stock., 78: 1502, 1916.
14. Carman, *J. Radiol.*, I: 246, (April) 1920.
15. Castiglione-Morelli, P. *Gaz. d. Osp.*, Milan, 23: 820, 1902.
16. Cohen, H. *Med. J. & Rec.*, 127: 611, 1928.
17. Conrath, V. *Beit. zur Klin. Chir.*, 21: 1898.
18. Corner, E. M. *Lancet*, 2: 1825, 1910.
19. *Brit. M. J.*, 2: 913, 1908.
20. Cornils, E. *Deutsch. Ztschr. f. Chir.*, 187: 422, 1924.
21. Counseller, V. S. *Proc. Mayo Clin.*, 4: 309, 1929.
22. Crowder. *Am. J. M. Sc.*, 119: 668, 1900.
23. Darier, J. *Bull. Soc. Anat. d. Paris*, 4. 89, 1890.
24. Decloux. *Cong. Internat. d. Med. Paris*, 13th congreè, 13: 357, 1900.
25. Desmarest, *Sem. d. hop. d. Paris*, 3: 486, 1926.
26. Dowd, C. N. *Ann. Surg.*, 35: 806, 1902.
27. Eisendrath, D. N. *J. A. M. A.*, 52: 291, (Jan. 23rd) 1909.
28. Erdheim, S. *Wien. klin. Wchnschr.*, 13: 79, 1900.
29. Estor, Grynfeltt and Aimes. *Montpel. Med.*, 43: 18, 1921.
30. Félix, M. Les rétréci sements tuberculeux de l'intestin grêle; leur tra'tement. Paris, 1900.
31. Fibiger, J. *Hosp.-Tid.*, 8: 649, etc., 1900.

32. Francoz, C. Rétrécissements de l'intestin grêle consécutifs aux hernies étranglées, 1899.
33. Frank, E. *Prag. med. Wchnschr.*, 15: 289, 1890.
34. Galcotti, C. *Suppl. al Policlin.*, 6: 353, 1889.
35. Goldberg, B., and Smithies, F. *Bull. Chicago Mun. Tuberc. San.*, 9: 5, 1929.
36. Grimsgaard, V., and Niedayson, J. *Nord. med. Ark.*, 3. f., I, afd., 1: no. 9, p. 1, 1901.
37. Haggard, W. D. (Reprint) Source unknown.
38. Halsey, F. W. *N. Eng. Med. Gaz.*, 33: 61, 1898.
39. Hartman and Pillet. *Bull. d. la Soc. d. Anat., Paris*, p. 471, 1891.
40. Hartman. *Brit. M. J.*, I: 849, 1907.
41. Henry, F. P. *Tr. Path. Soc., Phila.*, 13: 34, 1885.
42. Jameson, W. B. *Am. Rev. Tuberc.*, 9: 423, 1924.
43. Lemon, W. S. *Minnesota Med.* 6: 300, 1923.
44. *Minnesota Med.*, 6: 572, 1923.
45. Lennander, K. G. *Upsala Lakere f. Forh.*, 2: 442, 1896.
46. *Berl. klin. Wchnschr.*, 35: 701, 1898.
47. Litten. *Deutsch. med. Wchnschr.*, 11: 850, 1885.
48. Loew, A. *Wien. Arch. f. inn. Med.*, 4: 19, 1922.
49. Lynch, J. M. *J. A. M. A.*, 84: 24, 1925.
50. Marchant, G. *Bull. et mem. Soc. Chir. d. Paris*, 5: 26, (Jan.) 1900.
51. Markley. *Minnesota Med.*, 7: 151, 1924.
52. Masson, J. C., and McIndoe, A. H. *Proc. Mayo Clin.*, 4: 105, 1929.
53. Motel, E. Étude de la tuberculose de l'intestin grêle ā forme hypertrophique, Paris, 1900.
54. *Arch. prov. d. med.*, 2: 293, 1900.
55. Nicolayson, J. Des strikturerende tyndtarmtuberculose og dens kirurgiske behandlung, Kristiania, 1908.
56. Nikolski, A. V. *Prakt. Vrach.*, 1: 425, 1902.
57. Oddo, C., and deLuna, C. *Bull. et mem. Soc. med. d. hop. d. Paris*, 45: 27, 1921.
58. Pagel, W. *Frankfurt. Ztschr. f. Path.*, 33: 159, 1925.
59. Parker, D. W. *Bost. M. & S. J.*, 167: 915, (Dec.) 1912.
60. Patel, M. Les tuberculoses chirurgicales de l'intestin grêle; lene therapeutique, Lyon, 1901.
61. *Gaz. hebd. d. med.*, 5: 613, 1900.
62. *Lyon med.*, 96: 269, 1901.
63. *Rev. d. Gynec. et d. chir. abd.*, 6: 85, 1902.
64. Patel, M., and Morenas. *Lyon med.*, 134: 394, 1924.
65. Ransohoff, J. *Ann. Surg.*, 72: 196, 1920.
66. Richardson, M. H. *N. Y. State Jour. of Med.*, 1: 143, 1901.
67. Rollier, A. Heliotherapy. Oxford Med. Pubs. Sond. N. Frowde; Hodder and Stoughton, 1923.
68. Röpke, E. *Beitr. z. klin. Chir.*, 144: 453, 1928.
69. Schüppel, A. *Deutsch. Zeitschr. f. Chir.*, 166: 375, 1921.
70. Schwatt, H. *Am. Rev. Tuberc.* 8: 9, 1923.
71. Siegmund, H. In: Path. Anat. und Hist. d. Verdauungsschlauchs, Berlin, 1929, Vol. 3, chap. IV.
72. Soubeyran, P. *Montpel. med.*, 14: 470, 1902.
73. Stewart, D. A. *J. Canadian M. A.*, 13: 20, (Jan.) 1923.
74. *Am. Rev. Tuberc.*, 15: 588, 1927.
75. (Unnamed) *Rep. Superv. Surg.-Gen. Mar. Hosp., Wash.*, 1891–2. Wash., 1893, p. 188.

76. VIANNAY. *Loire med.*, 33: 250, 1914.
77. WARWICK, M. *Ann. Surg.*, 71: 139, 1920.
78. WEBB, G. H. *Trans. Nat. Tuberc. Ass.*, 20th annual meeting.
79. WILKIE, J. D. *Internat. Clin.*, 4: 45, 1927.
80. WRIGHT, C. B. *Jour.-Lancet*, 44: 147, 1924.

Also many other articles concerned only with tuberculosis of large bowel or of ileocecal valve.

# CANCER OF THE RECTUM AND RECTOSIGMOID

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THE description of the pathological anatomy of cancer of the rectum and rectosigmoid as given by Mr. W. Ernest Miles[1] constitutes one of the classics of modern surgical literature. Nothing of importance has been left out. It forms a complete working foundation for rational treatment. Every surgeon of broad experience must recognize its accuracy. Everyone writing upon this subject must consciously or unconsciously draw heavily upon this document.

According to Miles, adenocarcinoma is the only type of cancer that is met with in the rectum. There are four clinical varieties: papilliferous, adenoid, colloid or mucoid, and melanotic. The papilliferous growth extends rapidly along the mucous membrane and soon involves the whole circumference of the bowel. It grows very rapidly and soon fills up the entire lumen of the bowel and produces obstruction. It is slow to infiltrate the muscles and is therefore one of the least malignant forms of carcinoma of the rectum. When seen early it is amenable to local treatment such as radium, actual cautery, or resection operation in which the sphincter may sometimes be preserved. The adenoid type is sessile, early involves the deeper structures and penetrates the muscles, enters the fat outside the rectum within the fascia propria and finally involves and penetrates the fascia propria and attaches to the pelvic wall and the organs and tissues surrounding the rectum. This is the common or usual variety of carcinoma of the rectum. The colloid or mucoid carcinoma is simply an advanced stage of the adenoid while the melanotic carcinoma partakes of the nature of melanotic tumors wherever found and is important in connection with treatment in that it is always fatal,

and therefore not amenable to any treatment other than palliative.

We may therefore devote most of our attention to the adenoid type of carcinoma which has been so well described by Miles as follows:

> The great majority of cancers of the rectum are of this kind. They are usually seen as sessile tumors involving the mucosa and submucosa. In the majority of cases the growth is flattened, the transverse diameter being greater than the longitudinal. The tumor increases in size in all directions and though at first freely movable upon the muscular coat, soon infiltrates and becomes adherent to it. It is impossible to say how soon after the inception of the neoplasm deep infiltration takes place but probably it occurs within six months. As the growth increases in size, surface disintegration occurs and a definite ulcer, exhibiting the well-known malignant characters, is formed. Even at this early stage the retrorectal lymph glands are usually invaded, thus showing that extramural dissemination of cancer cells takes place while the growth is still in a clinically early stage of development. As more of the circumference of the bowel becomes involved, the ulcer deepens and assumes a crateriform appearance with nodular, everted, and indurated edges. When the ulcer has extended nearly all round the bowel, stenosis of the lumen is produced and then the stage is reached when symptoms of impending obstruction make themselves manifest. The adenoid cancer gives rise to extramural metastases which may be widespread while the growth is yet in an early stage clinically, and therefore must always be considered as highly malignant. It will inevitably recur after a restricted operation.

A carcinoma usually extends more rapidly in the circumference of the bowel than longitudinally as shown by the fact that a growth which extends entirely around may not be more than an inch or two in width from above downwards, even in the ampulla of the rectum. In the rectosigmoid where the intestine is surrounded by peritoneum, the growth entirely surrounds the bowel with a still narrower ring.

Miles has made some important observations as an estimate of the progress made in the advance of the growth of carcinoma. He estimates that it requires six months for the growth to travel one-fourth the way around the intestine and that about the same time is required for the lateral extension to fix the

mucosa to the muscular layers. He reports four cases in which he saw the growth in an early stage of development and in which the patients either refused operative treatment or were unable to submit to it for some reason or other. The growth in each of these patients when first seen was freely movable upon the subjacent muscular coat. At the expiration of a year after the first examination the extent of the circumference of the bowel which had become involved in each of the four cases was five-sixths, four-fifths, four-fifths, and three-fourths respectively. He, therefore, believes that when the growth has involved three-fourths of the circumference of the bowel, it has existed for at least eighteen months. Miles believes that the fascia propria is usually not involved until about this time. He is of the opinion that invasion of neighboring structures, such as the sacrum, uterus or vagina, prostate, or bladder, does not take place in less than a year after the first appearance of the objective symptoms or a year and a half after the incipiency of the growth. He believes that if direct extension were the only means of spread of the growth, the surgical treatment of the disease would be quite simple and a local operation entailing nothing but the removal of the intestinal tube containing the cancer would be all that would be necessary to cure the patient. In this connection, he says: "Unfortunately, however, other and more important modes of spread take place simultaneously and with greater rapidity, leading to distant dissemination even when the primary growth is still in an early phase of development." He refers to the spread by means of the venous system and the lymphatic system. When the growth involves the venous radicles a mass of cancer cells may often be seen inside the lumen of the vein. When such an embolus of cancer cells breaks off, it may float down the portal vein and lodge in the liver. While Miles states that venous metastasis begins in the center of the right lobe, I have personally seen, in a number of instances, the only palpable liver growth in the left lobe. Liver metastasis is a late manifestation except in cases where treatment has

been given such as the local removal for biopsy, use of the cautery and more particularly radium. In a few cases where radium has been used some months prior to operation, I have later opened the abdomen with the intention of doing a radical operation. In every case of this kind, a metastatic nodule has been felt in the liver. Miles calls attention to the fact that if the right lobe of the liver is very large, even though there is no nodule on the surface, the enlargement is probably due to a metastasis in the center of the lobe, and is a late manifestation usually showing only in advanced stages of the disease. The usual method of spread of cancer is through the lymphatics. It is therefore important to study the anatomy of the lymphatic system. After doing so, one is convinced of the necessity of a radical operation.

Anatomists divide the rectal lymphatics into three groups: (1) The intramural lymphatics which lie in the wall of the bowel between its various layers. (2) The intermediary lymphatic system in which the lymphatics lie under the peritoneum and there form a so-called lymph sinus. Where there is no peritoneal investment, they lie in the perirectal fat. The lymph spaces around the intestines in this way serve as collecting stems from the intramuscular network of lymph vessels which empty directly into this lymph sinus. It is the belief of Miles that a detached cancer cell after entering this sinus may wander to any part of it before entering the extramural lymphatic system. (3) The extramural lymphatic system is the most important of all. The collecting stems from the lymph sinus enter into a relation with the lymphatic glands which are scattered over the surface of the rectum among the branches of the superior hemorrhoidal vessels. The efferents from this plexus and from the anorectal glands pass to their destination upward, downward or laterally.

Miles has paid particular attention to peritoneal involvement and believes that the pelvic peritoneum is especially liable to invasion. He has observed plaque deposits in the peritoneum of the pelvic floor in all segments from the middle

line to the brim of the true pelvis. The peritoneum is in close relationship with the lymphatic network situated between the levatores ani and pelvic fascia. He believes that it is essential that the peritoneum of the entire pelvic floor, as far as the brim of the true pelvis on both sides, should be removed in every case of extirpation of the cancerous rectum. In mentioning his early excision operations in which he excised the coccyx, removed a narrow strip of perianal skin, removed a scanty amount of ischiorectal fat and divided the levatores ani close to their attachments to the rectum, and severed the bowel an inch or so above the upper margin of the growth, recurrence ensued in every instance.

He then states:

> By extending the scope of the operative procedure in successive series, I ultimately arrived at a removal which was the most complete that it was possible to carry out from the perineum. The type of operation was as follows: Preliminary colostomy, subsacral Kraske's or Bardenheure's method of exposure; wide removal of perianal skin; free excision of the ischiorectal fat; complete removal of the rectum encased in its covering of fascia propria; removal of the lowermost part of the pelvic mesocolon together with the retrorectal glands; free incision of the pelvic peritoneum and the peritoneum of the pelvic mesocolon so as to permit of several inches of the pelvic colon being drawn down; section of the bowel at or near the middle of the loop. Although this type of operation was the most extensive that it was possible to carry out from the perineum, it did not suffice to reduce the recurrence rate to any appreciable extent, recurrence taking place in 94.4 per cent of the cases.

He believes that failure to prevent recurrence was due to the fact that tissues of the upward zone of spread, already invaded, lay beyond the reach of any operation carried out solely from the perineum. He believes that an attempt to excise a cancerous rectum from the perineum alone is as futile as amputating a breast affected by cancer without also clearing the axilla of invaded lymphatic glands.

With this conviction in mind, he planned a radical abdomino-perineal operation which was sufficiently extensive to

embrace the tissues of the zone of upward spread in addition to those of lateral and downward zones. By this means, he removed the whole of the pelvic colon and rectum encased in its sheath of fascia propria, the whole of the pelvic mesocolon, the peritoneum lining the floor as well as the walls of the true pelvis, the whole of the levator ani and coccygeus muscles, the external sphincter muscle, as much as possible of the ischio-rectal fat and a wide area of perianal skin.

While the operation was all done at one operation, it was divided into two stages. Through an abdominal incision, the sigmoid was severed high up, the sigmoid arteries and the terminal branch of the inferior mesenteric or superior hemorrhoidal artery ligated, the fat in the hollow of the sacrum mobilized, the peritoneum in the floor of the pelvis removed, the closed distal segment of the intestine dropped down and the cut edges of the peritoneum of the pelvic wall sewed together over it forming a diaphragm or new pelvic floor. Patient was then turned over, a larger area of perianal skin removed, coccyx, levator and sphincter muscles around the anus all removed with the rectum, after which the cavity was packed with gauze. The original description of the principles of this operation was published in *The Lancet*, December 12, 1908.

In 1912 W. J. Mayo[2] introduced the two-stage operation with the statement: "The combined abdominosacral operation in two stages has much to commend it and has a mortality of less than one-half that of the abdominoperineal operation in one stage." In this article he presented two methods of doing the two-stage operation. At the first stage, he did a simple colostomy. A week or two later the Kraske operation was performed from below leaving a closed end of the sigmoid below the colostomy. This was the operation which is known today as the posterior resection and is practically the same operation as that used by Lockhart-Mummery referred to in his report of cases later in this article. His second operation which was recommended for cases in which the growth extends high in the lower sigmoid was as follows:

A midline incision is made suprapubically, the exploration completed, and the sigmoid brought up and divided between two ligatures and both ends sterilized. The distal end is invaginated into the bowel with a purse-string suture, and the superior rectal artery tied. The mesosigmoid is divided above the promontory of the sacrum, the peritoneum divided on each side as far as the bottom of Douglas' pouch, and the fat and glands separated from their posterior attachments to this point only. The distal end of the sigmoid with the attached fat and glands is depressed and the peritoneum closed down and over the top of the mass. The anterior peritoneal attachments to the bladder and the lateral attachments of the rectum and lower sigmoid are not disturbed because the main blood supply through the superior rectal vessel has already been cut off. The end of the proximal sigmoid is brought out through the middle of the left rectus muscle as a permanent colostomy. A tube must be inserted into the lower fragment through the natural anus to carry off the discharges and to enable cleansing by gentle irrigation.

He then says: "This is an excellent method, but has an increased mortality over the method first described. It should not be practiced in the very obese, nor in those with obstruction. We had one patient die several days following the colostomy from perforation of the lower fragment."

Because of this danger of perforation reported by Dr. Mayo in his article, I set about to work out a plan to avoid this danger. This was accomplished by extending the abdominal part of the operation to include the separation of all the fat in the hollow of the sacrum down to the coccyx, after which the sutured end of the sigmoid was attached to a tube which had been previously passed into the rectum and which served to invert the sigmoid by pulling the severed end out through the anus. The peritoneum was then drawn across the raw surface in the pelvis and the abdomen closed (Fig. 1). This operation was described under the title, "The Major Procedure First in the Two-stage Operation for Relief of Cancer of the Rectum,"[3] at which time 8 cases were reported. Of the 8 cases, the internal iliac arteries had been ligated in 4 cases as an additional safeguard in control of hemorrhage. In practically all the cases, local infection developed around the end of the sigmoid and a good deal of fever developed along with the

formation of pus in some cases. At the second stage of the operation, the last joint of the sacrum and the coccyx were removed. The local infection in some of these cases lasted for a

FIG. 1. Sectional view of sigmoid inverted and drawn out through the anus. Also the peritoneum sutured over end of inverted gut. (*Ann. Surg.*, April, 1915.)

week or two so that it was decided to drain through the abdominal incision in men and through the vagina in women. It was soon found possible to sew the peritoneum around the drain, thus making the drain practically extraperitoneal. A number of gauze wicks were used as a drain. Soon experience proved that still larger packages of gauze wicks gave better results so finally the operation used today was evolved. This operation was equally as radical as the Miles operation and being a two-stage operation gave a smaller mortality.

In 1915, Daniel Fiske Jones[4] described a two-stage combined abdominosacral operation for carcinoma of the rectum. His operation is equally as radical as the preceding operations but involves quite a different procedure. The essential points as given by Jones are as follows:

> 1. The inferior mesenteric is tied high, and removed with the lymphatic channels accompanying it. 2. The sigmoid and rectum can be left in situ, after tying the inferior mesenteric and dissecting the pelvis, without fear of gangrene, as the vascular arches from the middle and left colic arteries *continued in the sigmoid arteries* are left in tact to supply the bowel. 3. A thorough dissection of the pelvis is made, including most of the lateral glands, into which some lymphatics of the rectum drain. 4. By closing the peritoneal flaps about the intestines, the second stage of the operation is entirely extraperitoneal. 5. The effect of sepsis is much diminished. The five days between the two stages seem to be sufficient to seal the lymphatics of the pelvis, which reduces the immediate effects of the infection.

The foregoing operations cover all the principles used in the modern operation for cancer of the rectum. It is the task of every surgeon to evaluate the importance of the various operations. In as much as each author is likely to be an enthusiastic advocate of his own operation, we must resort to comparative statistics to help us obtain a correct estimate.

## STATISTICS

Statistics in surgical papers are usually introduced for the purpose of strengthening an argument. Many times, in the maze of an argument, the truth contained in statistics is obscured by eloquence. Someone, I believe it was Lord Moynihan, has said, "Anything may be proven by statistics, even the truth." It is sometimes easy enough to get the truth but not the whole truth. In giving an individual's statistics nothing short of the individual's entire experience is very valuable. A very striking bit of evidence of this point was shown in a paper published some years ago on "Chronic Peptic Ulcer," in which 471 cases were reported with a mortality of 4.2 per cent. Chronologically, from Case No. 213 to

Case No. 370, 157 consecutive cases operated upon, there was no death. In looking over the chronological table it was noted that Case 370 and Case 372 terminated fatally. The series of 157 operations without a death had no more statistical value than the series of three operations immediately following in which there were two deaths, giving a mortality in this latter series of 66⅔ per cent. In cancer of the rectum, fortunately, we have several series of statistics which should have some value when all the series are compared.

In studying statistics, there are certain points which must be taken into consideration. (1), The general surgical ability or skill of the operator. (2) It must be appreciated that the originator of an operation, other things being equal, should do his special operation better than one who has not so carefully studied the principles. (3) Operability. Given two different series of 500 cases, constituting the entire number of patients seen and cases diagnosed, one surgeon operates upon 30 per cent, or 150 cases. Another surgeons operates upon 50 per cent, or 250 cases. It would be impossible to compare the results in the two series. It might be predicted that the first series would not have anything like the percentage of deaths and would have a much larger percentage of five and ten year cures. (4) Operators in the large centers where large charity hospitals exist, show better results with private cases than in their charity hospital cases. In the northwestern part of the United States where there are relatively few charity hospitals, the surgeon often operates at his own hospital where he must operate on the poor as well as the more prosperous patients. This condition would apply in such clinics as the Mayo Clinic and the Cleveland Clinic.

In studying end-results, it is the custom of authors to eliminate the cases which cannot be traced and assume the result would correspond to the ones which have been followed up. This probably leads to serious errors. It seems more than likely that a considerable percentage of these patients cannot be located because they are dead and therefore unable to

answer the follow-up letters personally and the family often has been scattered or has moved as a result of the death.

It would be most interesting to have the entire statistics of Miles but as far as I know such statistics are not available. In his own words, he[5] gives the following statistics for his radical abdominoperineal operation:

> My personal experience of the operation has extended to 72 cases, with the following results:
>
> Operation Mortality
>
> | | | |
> |---|---|---|
> | First series..... | 42 cases..... | 40 per cent |
> | Second series..... | 19 cases..... | 26.3 per cent |
> | Third series..... | 11 cases..... | 18.1 per cent. |
>
> The decrease in the mortality rate has, I think, been due partly to improvement in technique and partly to the substitution of spinal anaesthesia with gas and oxygen for chloroform and ether.
>
> *Recurrence Mortality.* Owing to having lost touch with cases during five years of war service I have been unable to trace the whereabouts of 17 of the 48 patients who survived the operation. Of the remaining 31, three died of intercurrent disease and eight died of recurrence. Leaving the 17 untraced cases out of consideration, the recurrence mortality works out at 28.5 per cent.
>
> *Cures.* The following patients, known to be alive and well, may be regarded as cured—1 after eleven years, 1 after ten years, 4 after nine years, 3 after eight years, 3 after seven years, and 4 after six years.

In his latest paper he says:[1] "During the last two years I have adopted blood transfusion as a routine measure with the result that the mortality has fallen to 7.6 per cent." As to operability, he says out of 1200 cases he has operated upon slightly less than 400: exactly 32 per cent operability. He gives a series of cases from 1920 to 1925 for the purpose of showing the percentage of cures. He does not state in this series as to the number of deaths from operation, but simply gives the number of survivals as 94. Of these, 8 are untraced. Known to be alive and well, there are 69, or 73 per cent, five year cures.

The foregoing statistics are so incomplete and patchy as to have little scientific value as an indication of the results of the

Miles' operation. The fact that in 1200 cases seen, there was only 32 per cent operability, makes it impossible to compare Miles' statistics with the statistics of Jones who in a similar series of cases reports an operability of 53 per cent. The report of his early cases indicates a prohibitive mortality rate. During the last two years he reports an exceptionally small mortality rate. Two years is entirely too short a time to furnish reliable statistics. For example, in my series beginning in 1914, Case No. 8 died. There was then no death until Case 32, an interval in which there were 24 cases without mortality. The same objection may be raised to selecting a series of cases from 1920 to 1925 as a criterion for permanent results.

Lockhart-Mummery[6] reports his total experience with 200 cases operated upon by the combined operation of colostomy and posterior resection in two stages. It is an interesting coincidence that he had exactly 100 private patients and an equal number of hospital patients. His mortality in his private cases was 3 per cent, while in the hospital cases it was 14 per cent, making an average of 8½ per cent mortality for his entire series. He does not state the operability in his cases but gives quite a clear definition of the proportion of the various types of cases under three heads as follows:

"A: Very favorable cases where the growth was small and had not apparently invaded the muscular coat, and no glands were involved." Under this classification there were 73 cases. Of these 30 were traced for a period of five years; 22 were cured, 8 had recurrence, 73.7 per cent cured.

"B: Medium cases where there was involvement of the muscular coat but where the growth was not unduly fixed and there was no extensive involvement of glands." Under this classification there were 96 cases. Of these, 43 were traced for a period of five years; 19 were cured, 24 had recurrence, 44.1 per cent cured.

"C: Very bad cases, where the growth was large and fixed, or where there was evidence of extensive involvement of glands. These were borderline cases with a bad prognosis." Under this

classification there were 31 cases. Of these, 9 were traced for five years, 4 were cured, 5 had recurrence, 44.4 per cent cured. Nine traced cases out of 31 under this classification are entirely inadequate. It must at once be obvious that in a large series of cases under this classification, the recurrences would be much larger than in the preceding classes.

From the foregoing classification, it is very evident that Lockhart-Mummery's surgical cases have been selected very carefully from a large number of patients with cancer of the rectum. I am sure that not more than 10 per cent of patients with cancer of the rectum coming to the average surgeon for examination will fall under classification A. My own experience shows much less than 10 per cent. In this connection, it is well to quote from Lockhart-Mummery's conclusions:

> That no statistics of this character are entirely satisfactory must be admitted, for they do not show the whole truth. The proper way in which such statistics should be worked out is to take, say, 500 consecutive cases of cancer presenting themselves for treatment, and show the number of cases operated upon, the operative mortality, and the percentage of cures, based on the original 500 cases. Such tables, if they could be worked out (as a matter of fact they cannot, as a large number of inoperable cases do not reach the surgeon at all), would form a useful guide as to the relative merits of different operative procedures. Unfortunately, they would show such a relatively low percentage of cures out of the total that they would be depressing reading. It is to earlier diagnosis that we must look for any material improvement in our cancer cures from operation.

Because of the obviously careful selection and consequent low operability, it would be impossible to compare Lockhart-Mummery's statistics with those of Jones who shows more than 50 per cent operability, but they are sufficiently accurate to show that Miles, with an operability of only 32 per cent, in reporting 94.4 per cent recurrences following a similar operation has probably based his conclusions on an inadequate number of cases.

In the Collected Papers of the Mayo Clinic for 1927, Rankin[7] made a comprehensive report as follows:

In this series which I am reporting the majority of the cases were treated by graded procedures of the following types: (1) Colostomy and posterior resection of the growth; (2) The Jones or the Miles procedure, especially applicable to carcinoma of the rectosigmoid and high rectal growths; (3) The Coffey operation, and (4) The Quenu-Tuttle or Harrison Cripps type of perineal excision.

From January 1, 1916 to January 1, 1926 resection was performed for carcinoma of the rectum in 602 cases at the Mayo Clinic. All of these growths were true rectal carcinomas and the series does not include malignant tumors situated at the rectosigmoid juncture, which present a different clinical picture and frequently necessitate the choice of a different surgical procedure. Of those patients dismissed from the hospital, 511 (93 per cent) were traced; 308 (60 per cent) had died and 203 (40 per cent) were living. In this series the males predominated over the females in the proportion of 378 to 224. The hospital mortality of the whole group was 8.9 per cent (fifty-four cases).

TABLE (Rankin)

DURATION OF LIFE AFTER ANY TYPE OF RESECTION JANUARY 1, 1916 TO MAY 15, 1924

| Patients Heard From | | Patients | Per Cent |
|---|---|---|---|
| 420 | Lived three years or more | 201 | 47.85 |
| 366 | Lived four years or more | 142 | 38.80 |
| 305 | Lived five years or more | 103 | 33.77 |
| 243 | Lived six years or more | 70 | 28.80 |
| 204 | Lived seven years or more | 55 | 26.96 |
| 165 | Lived eight years or more | 41 | 24.84 |
| 108 | Lived nine years or more | 23 | 21.29 |
| 58 | Lived ten years or more | 14 | 24.13 |

Concerning operability, Rankin makes the following statement:

At the Mayo Clinic, of the total number of cases (1727) of malignant disease of the rectum, resection or excision was performed in 602 (34.9 per cent), and palliative procedures were carried out in 343 (19.8 per cent). Thus, in 54.7 per cent of the cases some type of operative treatment was given, although only about one-third were resectable, while 782 (45.3 per cent) were found to be inoperable.

Rankin's statistics are very important and significant for they represent a ten year cross-section of surgery for cancer of

the rectum in which the work of a number of highly skilled surgeons using all the different recognized types of operations has performed a large number of operations. They are also significant in that they are confined entirely to cancer of the rectum proper, thus recognizing the fact that cancer of the rectosigmoid must be put in a separate classification which more nearly corresponds to the upper colon where the effects of intestinal obstruction must be dealt with as a problem independent of cancer itself. The low operability indicated is probably due to the increased use of radium.

Probably the most outstanding, accurate, and therefore most valuable individual statistics which have so far been published are those of Daniel Fiske Jones[8] whose enthusiasm, skill and large experience have placed his work in a very high place. I can do no better than to quote his statistics in his own words:

> The series of cases presented for consideration in this paper includes 285 in which the growth was removed. This is 53 per cent of the cases examined. During the last three years when radium has been used rather more in the advanced cases, and in the very old and feeble, we have performed a radical operation in 47 per cent of the cases examined, radium has been advised in 25 per cent and a colostomy or no operation done in 28 per cent. Seventeen of the cases were treated by various methods: Perineal excision (Harrison-Cripps), resection and suture, local excision, and excision from above with a permanent colostomy. The number in each group is too small to make them of any particular value. Seven cases have not been traced, and are, therefore, put into the group of those living less than three years. We have, therefore, a series of 268 cases from which the following tables have been made up. In the following tables, the percentages of those living three and five years were obtained after deducting the immediate mortality. It is of interest to note than in at least 5 per cent of the cases one or more nodules, supposedly metastases, were felt in the liver at the time of operation.
>
> In Table I are given the statistics for all radical operations, both hospital and private cases. The percentages of three- and five-year cases are exclusive of death in the hospital in all the tables.
>
> In Table II are given the mortality and the percentage of cases living three and five years after the combined abdominoperineal operation in

TABLE I (Jones)
ALL RADICAL OPERATIONS

| | No. Cases | Per Cent Died in Hospital | Operated Three Yrs. | Per Cent Living Three Yrs. | Operated Five Years | Per Cent Living Five Yrs. |
|---|---|---|---|---|---|---|
| Private | 136 | 12.5 | 90 | 65.5 | 77 | 48 |
| Hospital | 132 | 33 | 68 | 66 | 61 | 47.5 |
| Private and hospital | 265 | 22.7 | 158 | 66 | 138 | 47.8 |

one and two stages and as a comparison the same figures for the combined abdominoperineal operation in one stage done under the best conditions, that is, in private practice. It will be seen that in properly selected cases the mortality in the one-stage operation is not high, and the precentage of three- and five-year cases is considerably higher than by any other operation. This is most gratifying and is conclusive proof, we believe, that the more extensive operation will give better results in those patients who can stand it than in those obtained from more limited operations. These are the statistics which should be compared with those of any other single operation, such as resection and suture, colostomy and posterior excision or any other single operation suggested for removal of cancer of the rectum.

TABLE II (Jones)
COMBINED ABDOMINOPERINEAL OPERATION—ONE AND TWO STAGES

| | No. Cases | Died in Hospital Per Cent | Cases Operated 3 Yrs. | Per Cent Living | Cases Operated 5 Yrs. | Per Cent Living |
|---|---|---|---|---|---|---|
| M. G. H. & Private | 204 | 22.7 | 120 | 70 | 103 | 50 |
| Private | 102 | 11.7 | 67 | 71.6 | 56 | 53 |
| COMBINED ABDOMINOPERINEAL OPERATION—ONE STAGE | | | | | | |
| Private | 54 | 5.5 | 38 | 78.5 | 32 | 56 |

In Table III will be found a comparison of the three important radical operations, the combined abdominoperineal operation in one and two stages and the colostomy and posterior excision. It will be seen that there is a gradual decrease in the cases living three and five years, from the abdominoperineal operation in one stage to a colostomy and posterior excision which suggests that the more extensive operation gives better results than the posterior excision. This is apparently denied by those who advocate the less extensive type of operation. It would indicate that the

more extensive operations should be carried out on those patients who are in sufficiently good condition to withstand the operation.

TABLE III (Jones)
END RESULTS
Abdominoperineal Operation—One Stage

| No. Cases | Died in Hospital Per Cent | Lived 3 Yrs. Per Cent | Lived 5 Yrs. Per Cent | Untraced |
|---|---|---|---|---|
| 93 | 17 | 73 | 53 | 2 |
| Abdominoperineal Operation—Two Stages | | | | |
| 111 | 27 | 68 | 48 | 4 |
| Colostomy and Posterior Excision | | | | |
| 61 | 22.8 | 50 | 40 | 1 |
| Abdominoperineal Operation in One and Two Stages | | | | |
| 204 | 22.7 | 70 | 50 | 6 |

My personal experience is shown in the following tables, the first three of which represent the results of a follow-up survey

TABLE I (Total Cases as of May, 1928)

| | | | |
|---|---|---|---|
| Total cases of carcinoma of the rectum and rectosigmoid operated upon from March, 1914 to May, 1928 | | | 152 |
| Total patients not operated on. | Inoperable even for exploration | 13 | 24 |
| | Refused operation | 6 | |
| | Went elsewhere | 5 | |
| Exploration and palliative operations. | Exploration | 12 | 49 |
| | Colostomy with or without radium | 32 | Rectum 25 |
| | Tube resection | 1 | Rectosigmoid 24 |
| | Radium alone | 4 | |
| Radical removal | Rectosigmoid including obstructive cases | 14 | 79 |
| | Rectum | 65 | |

TABLE II (Results of Operation with Inversion Technique)

| | |
|---|---|
| Total cases operated upon | 65 |
| Deaths from operation—4 mortality | 6.15 per cent |

made in May, 1928: rectosigmoid group includes all obstructive cases and includes a large per cent of the mortality of my series. Because of the inclusion of these obstructive cases, and the consequent high mortality, the three-stage operation has been adopted as a routine procedure for rectosigmoid cancer. Therefore, statistics in this group are omitted and only statistics on cancer of the rectum proper, in which it is possible to invert the sigmoid through the rectum will be included.

## END RESULTS

In considering end results only five-year cures are included. Therefore, only those cases operated upon more than five years ago are studied. Total cases, 32; deaths, 2; mortality, 6.25 per cent. Of the 30 surviving operations, 3 have not been traced since operation. Six were traced and were well two years or more after operation since which time we have not been able to trace them. This leaves 21 cases for the study of end results.

TABLE III

END RESULTS IN 21 TRACED CASES

| | | |
|---|---|---|
| 1. Patients dying before the expiration of five years | | 8 |
| Cause and date not known | 1 | |
| Recurrence in liver, three and one-half years | 1 | |
| Recurrence in liver three years | 1 | |
| Cause not known, two years | 1 | |
| Local recurrence of cancer, two years | 1 | |
| Local recurrence of cancer, twenty months | 1 | |
| Local recurrence of cancer, seven months | 1 | |
| Recurrence in lung, eight months | 1 | |
| 2. Lived five years or more—(62 per cent) | | 13 |
| 3. Still alive and well | | 8 |
| Thirteen years; twelve years; six years, four months; six years, three months; six years, one month; five years, eleven months; five years, three months; and five years after operation. | | |
| 4. Patients dying after expiration of five years | | 5 |
| Apoplexy, thirteen years | 1 | |
| Pneumonia, six years | 1 | |
| Local recurrence, six years | 1 | |
| Auto-accident, five years | 1 | |
| Local recurrence, five years | 1 | |

## RECAPITULATION

In my first 32 cases there were 2 deaths (6.25 per cent). In my first 54 cases still 2 deaths (3.7 per cent). In 65 cases 4 deaths (6.15 per cent).

Taking into account the inaccuracy of such small statistics, it would seem fair to estimate that a death rate ranging from 5 to 10 per cent in the hands of skilled surgeons may be expected when this technique is used.

In 21 traced patients, 13 lived five years or more, 62 per cent five-year cures. Nine in a series of 30 is a large percentage of untraced patients.

Since May, 1928, when these statistics were prepared, 57 patients with cancer of the rectum and rectosigmoid have registered for diagnosis. Of these 10 were not treated either because they were inoperable even for exploration, went elsewhere, or refused operation; 21 cases were treated by colostomy with or without radium; 4 cases were treated by radium alone; 1 case was exploratory only; 9 cases of carcinoma of the rectosigmoid had the radical operation and 12 of carcinoma of the rectum had the radical operation.

TABLE IV

| | |
|---|---|
| Total cases of carcinoma of the rectum and rectosigmoid | 209 |
| Inoperable even for exploration, refused operation or went elsewhere | 34 |
| Colostomy with or without radium | 53 |
| Radium alone | 8 |
| Tube resection | 1 |
| Explorations | 13 |
| Radical removal | |
| Carcinoma of the rectosigmoid | 23 |
| Hospital deaths | 5 |
| Mortality rate | 21.74 per cent |
| Carcinoma of the rectum, inversion technique | 77 |
| Hospital deaths | 5 |
| Mortality rate | 6.5 per cent |
| Total radical operations | 100 |
| Total number of hospital deaths | 10 |
| Percentage of hospital deaths | 10 |
| Operability for radical removal in the entire series of 209 cases | 47.8 per cent |

From the merging of this latter group of cases with the former statistics Table IV has been constructed.

Cancer of the rectum has in the past been placed in the category or borderline operability. Contrary to the established belief the above statistics indicate that, there are few parts of the body so favorably situated as the rectum for complete devascularization and removal of all the involved tissues in case of cancerous invasion. Most of the blood supply for the ampulla of the rectum and the rectosigmoid, as well as that of the connective tissue and fat found in the hollow of the sacrum, comes through one vessel, the superior hemorrhoidal artery. Most of the return circulation goes back through corresponding veins and these vessels are accompanied by the lymphatics, which together serve as almost the sole avenue for the spread of the disease upward. These vessels may all be included in a single ligature placed opposite or just below their crossing of the promontory of the sacrum in the mesosigmoid. It will be seen by the composite colored plate (Fig. 2) that this ligature at once severs the blood supply and the venous and lymphatic return circulation, thereby removing the danger of hemorrhage as well as upward metastasis during the further progress of the operation.

While it is true that some prefer the one-stage operation, I am very sure that the average operator, equally skilled in doing both the one-stage and the multiple-stage operation, will obtain better results with the multiple-stage. After a decision has been reached as to whether one-stage or a multiple-stage is preferable, the next question is what type of one-stage operation or what type of multiple-stage operation is to be used. In considering the one-stage operation, it would seem that Miles has so well met the demands of both anatomy and pathology that unless and until new and contradictory knowledge as to the nature and method of the spread of cancer has developed, no vital change can be made in the Miles operation. In short, any completely radical removal of the rectum and pelvic colon along with all other tissues involved in connection with cancer

FIG. 2. A. Complete devascularization from above is possible by ligation of the superior hemorrhoidal vessels at the promontory of the sacrum. Note arteries, veins and lymphatics.

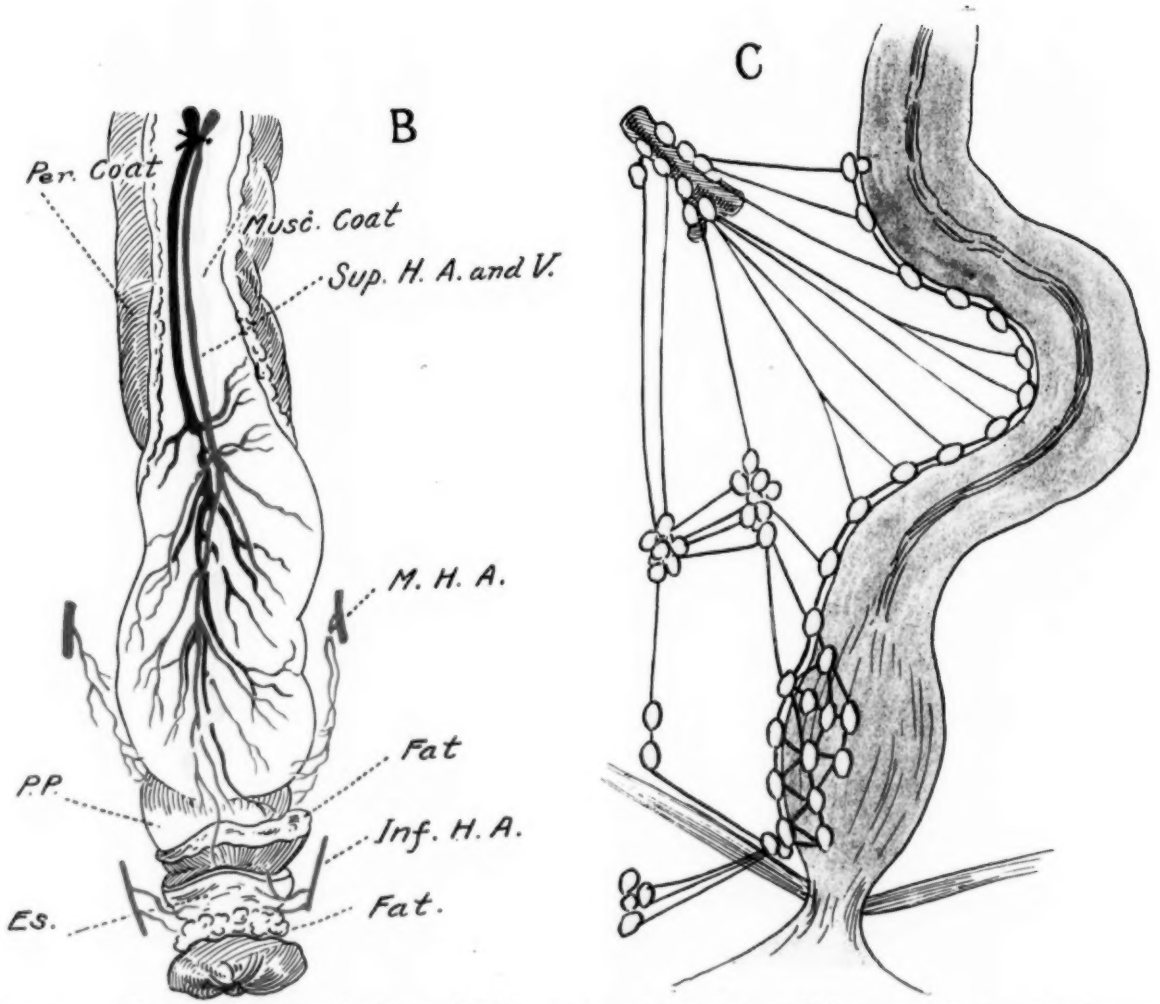


FIG. 2. B. Direct view of superior hemorrhoidal vessels and lymphatics which occupy the retrorectal space. The ligation of these vessels devascularizes the ampulla of the rectum and rectosigmoid.
C. Elaboration of Miles' picture showing the lymphatics of the rectum. (*Surg. Gynec. Obst.*, June, 1924.)

of the rectum performed at one stage rightly must be termed the "Miles operation," regardless of minor changes that may be made by someone else.

In considering two-stage operations, three definite types have been devised in this country: (1) the Mayo operation; (2) the Jones operation, and (3) the operation which is later described in this article. The Mayo operation has been termed the "posterior resection operation" which has been preceded by a simple colostomy performed a few days earlier. Theoretically, this operation falls short of complete removal of the cancer-bearing area but clinically it has produced remarkable results and is a very popular operation today, particularly in this country and in England. The Jones operation is based on the pathological principles enunciated by Miles. The principle by which the operation is performed in two stages is highly original. At the first operation, besides bringing up the bowel for a colostomy and ligation of the inferior mesenteric artery as Miles has done, he carefully preserves the colonic arches along the sigmoid by which an adequate circulation is preserved to maintain the vitality of the bowel until the second operation is performed. He then removes the fat and glands in the hollow of the sacrum, the base of the mesentery of the sigmoid, and mobilizes and elevates the pelvic parietal peritoneum and sews it across the pelvis as a new pelvic diaphragm which is brought around the intestine sufficiently high above the growth that the second operation for removal of the growth will be extraperitoneal.

Cancers located in the lower 8 inches of the bowel are usually classified as cancer of the rectum and statistics compiled on this subject usually include all cancers of this segment in the same category as regards the type of surgical treatment and as regards the surgical mortality. We are learning in recent years that the principles involved in the surgery of the upper, or rectosigmoid segment, are very different from those in the lower, or ampullar segment. In studying large statistics, such as are included in Jones' recent

article, no differentiation is made in the mortality risk of the two classes of cases. I have a feeling that if the results of operation for cancer of the rectum should be separated into two classes: the high or rectosigmoid cancer and the low or ampullar cancers of the rectum, it would be found that the mortality rate is made much higher by including the rectosigmoid cancers.

In 1915, I described a two-stage abdominoperineal operation for removal of cancer of the rectum in which the major part of the operation was done at the first stage through an abdominal incision. The pelvic colon was mobilized by cutting the peritoneum on each side of the mesentery. The superior hemorrhoidal artery opposite the promontory of the sacrum was ligated. All the fat and lymphatics in the hollow of the sacrum down to the coccyx were mobilized and removed. The sigmoid was severed. Permanent colostomy was performed with the proximal end. The distal sigmoid was inverted and drawn out through the anus. The peritoneum was sutured across the pelvis, making a diaphragm which shut the inverted bowel off from the free peritoneal cavity. In the first four cases, the internal iliac arteries were ligated also. Later experience showed that it was unnecessary to ligate the iliac vessels. On account of sloughing fat resulting from complete devascularization, it was found necessary to drain with a large protected pack of gauze wicks. In general the following plan[9] has been used in most of the cases reported in the foregoing tables:

### TECHNIQUE

A long right rectus incision is made about an inch to the right of the median line extending slightly above the umbilicus. Through this incision, a search is carefully made for metastatic growths in the liver and in the mesentery and retroperitoneal glands. The growth itself is carefully examined through the abdominal incision. If a metastatic growth is discovered in the liver or in the retroperitoneal space, it goes without saying that the plan for the radical removal of the rectum should be

FIG. 3. The sigmoid is mobilized by cutting the peritoneum on each side of its mesentery. Dotted line indicates incision of peritoneum of cul-de-sac around rectum and between bladder and rectum with long handle angle scissors.

abandoned for palliative measures; likewise, if the growth involves the bladder or the firm pelvic wall. This long incision serves the purpose for exploration and for the manipulations

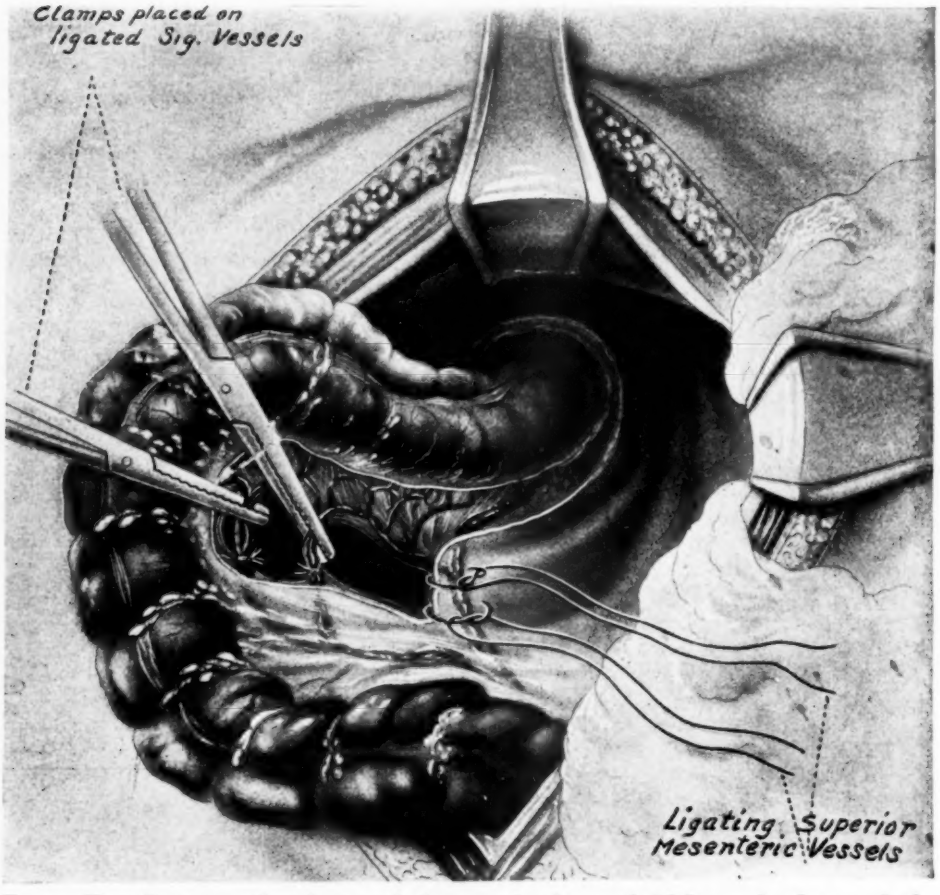


FIG. 4. Two ligatures placed around the superior hemorrhoidal vessels about 1 inch apart. The sigmoid arteries tied on one side and clamped on the other.

of the operation. It is made on the right side because the permanent colostomy is to be made on the left side. It is always best to make a colostomy wound through a separate stab wound. By having the large operating incision on the right side and the colostomy on the left side, it is possible to protect the large clean wound from the infection of the colostomy.

Having decided to do the radical operation, the intestines are packed well up into the upper abdomen with moist gauze, the exception being the sigmoid which is brought entirely below

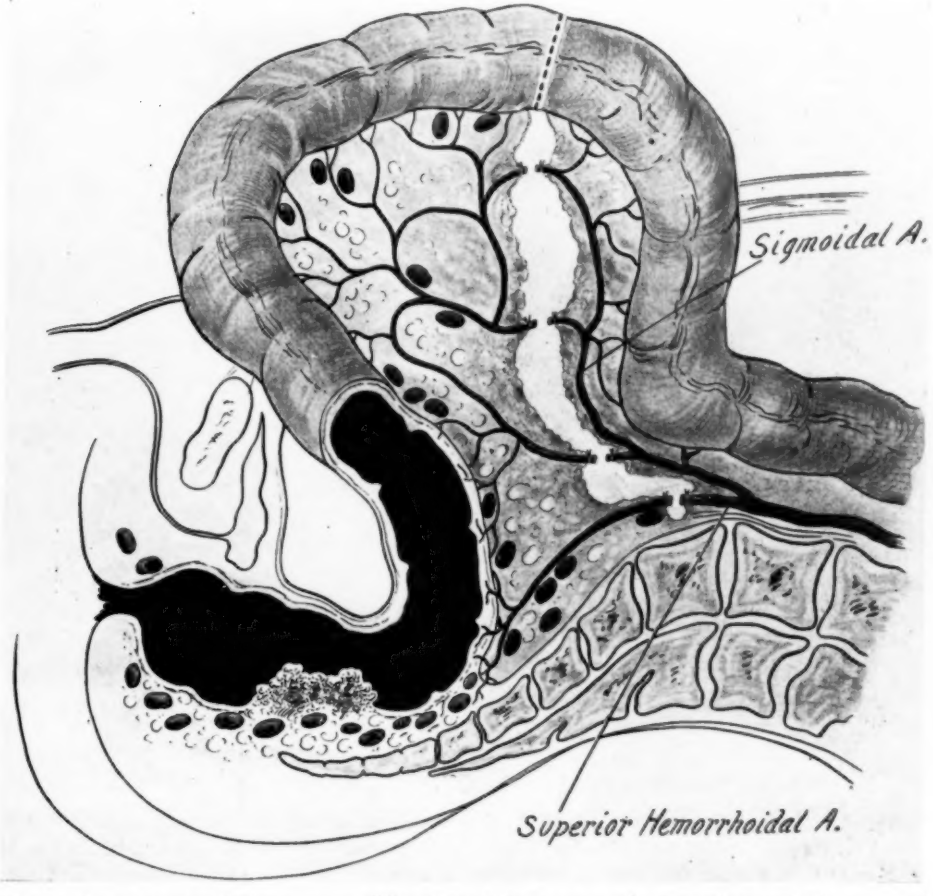


FIG. 5. Low cancer of the rectum. The dotted line across the intestine and the severed blood vessels indicate the amount of intestine, mesentery and lymphatic glands to be removed by the radical operation.

the wall of gauze. With the left hand, the loop of the sigmoid is lifted high up, the peritoneum of the mesentery is cut down by insinuating the blade of a pair of blunt scissors beneath the peritoneum but external to the vessels. This incision goes down into the pelvis around in front of the rectum, at some distance from it, clipping the rectovesical fold near the bladder. Special angle scissors are made with long handles and a

blunt or probe point on the lower blade (Fig. 3). The left forefinger is now inserted through the mesentery where the peritoneum has been cut and with the ends of the forefinger

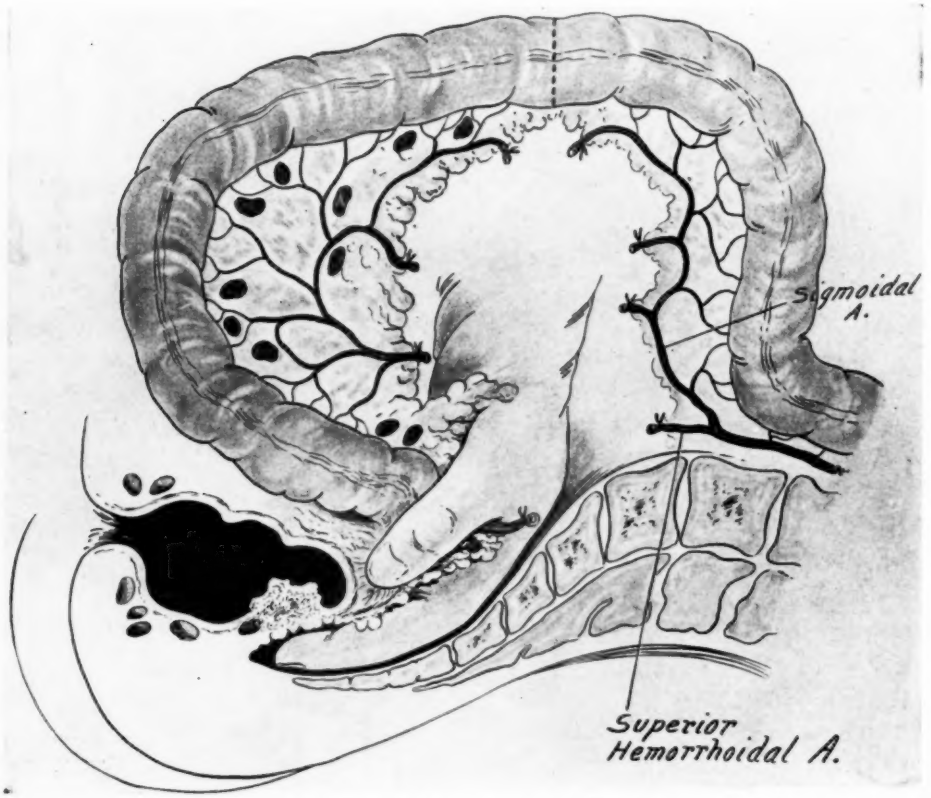


FIG. 6. After the rectum and sigmoid have been mobilized by cutting the peritoneum on either side of the mesentery and severing the rectal and sigmoid arteries, the fat in the hollow of the sacrum is mobilized down to the tip of the coccyx by finger dissection.

and thumb directed backward toward the promontory of the sacrum, and brought together, the superior hemorrhoidal artery is felt about ¾ of an inch in front of the bone. Its pulsation is about as strong as the radial artery. A large ligature, usually a double chromic catgut suture, No. 2 size, is passed beneath the artery with a long curved ligature carrier, the loop of thread is picked up on the opposite side and brought through the mesentery and around the large vessel and tied very tightly

in order to squeeze out the fat in the mesentery. A similar ligature is placed an inch lower down. The mesentery, including the artery and vein, is now severed between the two ligatures. The sigmoid arteries coming from above are grasped in forceps and ligated so as to cut off completely the circulation from this source. (Fig. 4.) The fingers of the left hand are then insinuated between the ends of the severed superior mesenteric artery and also between the lateral cut edges of the mesentery and pushed downward along the hollow of the sacrum, thus stripping off all the fat and connective tissue down to the tip of the coccyx. (Figs. 5 and 6.) If there is any return bleeding in the cut mesentery from below, this is stopped by grasping with forceps. After this separation, a large temporary gauze pack is placed in the hollow of the sacrum back of the rectum while the second major step of the operation is performed.

Before beginning this second step, we carefully determine the vitality of the circulation in the upper sigmoid which is to be used for permanent colostomy. It is very important to have a good circulation. This having been determined, an incision about 1½ inches to the left of the median line and about 1 inch below the umbilicus, 1½ inches in length, is made down through the left rectus muscle. A large Payr clamp is inserted through this incision, passed across within the abdomen to the main incision, where it grasps the proximal sigmoid at a point where it has been determined the circulation is good. Another clamp is placed just below, except that this clamp is in the main wound. The intestine is then severed with the cautery which is made to heat the blades of the clamp and thus sterilize it before it is drawn out through the wound (Fig. 7). It is pulled well up through the wound with the clamps where it is sutured to the layers of the abdominal wall, with fine double chromic catgut placed as a lock stitch, first sewing the peritoneum to the bowel wall, then the aponeurosis and finally a few interrupted sutures hold the skin to the peritoneal surface of the bowel. Usually about an inch of the bowel remains outside the skin.

When this part of the operation is completed, a rectal tube which was introduced into the anus by a nurse at the beginning of the operation, is now pushed up through the sig-

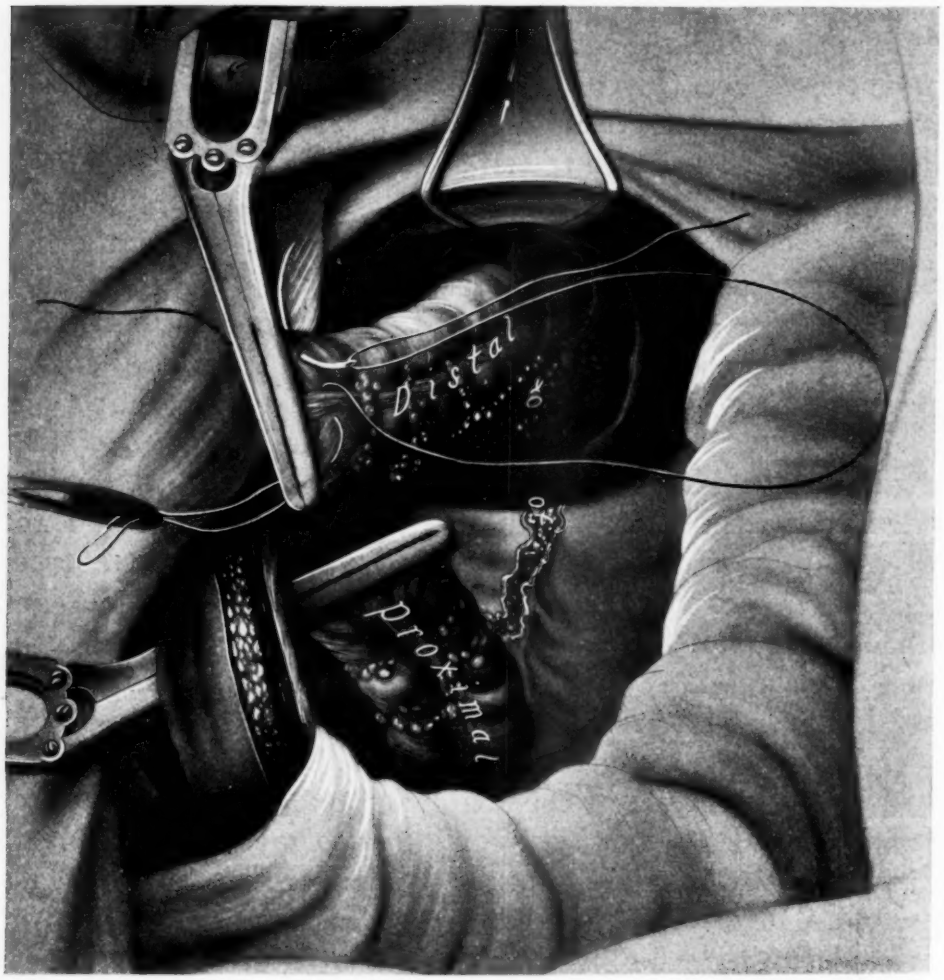


FIG. 7. Clamping and cutting the sigmoid after the vessels have been ligated. Note that one of the clamps passes through the stab wound in the rectus muscle.

moid to the point near the clamp on the distal gut. A purse string of linen is placed around the gut below the clamp, the clamp is removed, the end inverted. The tube is pushed up to the end of the gut, its eye is located, a round needle armed with four strands of strong linen thread is passed through the

FIG. 8. Proximal sigmoid has been fastened to layers of abdominal wall and its end held closed with a clamp. Tube is passed up to end of distal sigmoid, where it is fastened by a strong double suture passed through the intestine and eyes of tube and tied. By pulling on the tube, the sigmoid is inverted and drawn out through the anus.

wall of the intestine, through the eye of the rectal tube, out through the end of the rectal tube, through the opposite wall of the intestine and is brought out and tied in a long loop fully an

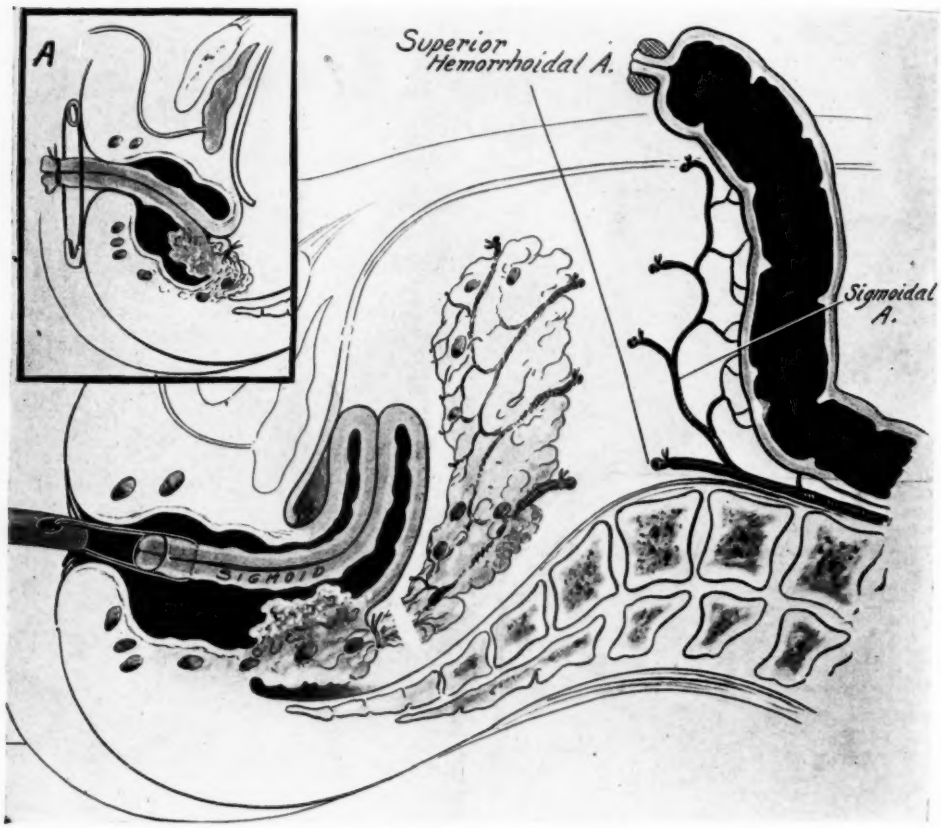


FIG. 9. Sigmoid is being inverted and drawn out through the anus. The mesentery of the sigmoid and rectum has been ligated and is being removed. The proximal sigmoid is brought out through the left rectus muscle for a colostomy. In insert A the inverted sigmoid is pinned outside the buttocks so that it cannot retract.

inch in length. The mesenteric fat on this distal gut is now trimmed off well down to the bottom of the pelvis; as much of the large sheet of fat which has been peeled off from the sacrum as possible may be ligated and removed. Artery forceps grasp the intestine on either side (Fig. 8), the nurse pulls on the tube, inverts the end of the gut down to the holding forceps when the forceps are made to grasp further down on the intestine, then the gut is pulled all the way down and out through the anus,

where it is held taut in inversion by a clamp placed on it on the outside or by a large safety pin. This loop of thread which attaches the rectal tube to the inverted end of the gut is made long so that the tube precedes the inverted end in going through the narrows of the growth. (Fig. 9.)

The next step in the technique of the first stage is to close all raw surfaces and openings so as to reduce to the minimum the danger of adhesions or postoperative obstruction. This is done as follows: First, the abdominal space to the left of the emerging sigmoid is closed by a double chromic catgut beginning in the lateral parietal peritoneum over the psoas muscle. A continuous lock stitch brings together the peritoneum of the front and back walls of this space. These sutures should be drawn very taut and should leave no open space. An extra reinforcement line of interrupted sutures is often used. From this point, the continuous suture is carried on down, covering in the raw cut edge of the mesenteric fat to the brim of the pelvis. At this point in the operation a large number of gauze wicks are carefully placed so that they reach the bottom of the pelvic cavity in contact with the hollow of the sacrum or coccyx. There should be enough of these to fill the deep pelvis loosely.

Increased experience has shown that the more gauze used in this pelvic drain, the better the patients have done until now three times as many gauze wicks are used to pack the hollow of the sacrum as was originally recommended. The reason for gauze drainage here in preference to a tube or other smooth material is that the retroperitoneal space to be drained is connective tissue space arranged in cells or spaces like a sponge. Fluid and any infection that it may contain are held by capillary attraction. A tube or soft substance will not drain connective tissue space. A large amount of gauze packed into connective tissue immediately drains out all fluid by capillary action until nature has a chance to form a definite wall of granulations. Those who have done this operation and have failed to use the gauze drainage have not met with success. Sheets

of 4-ply gutta-percha tissue are now made to surround the gauze wicks.

The suture is now continued, its scope being widened so as

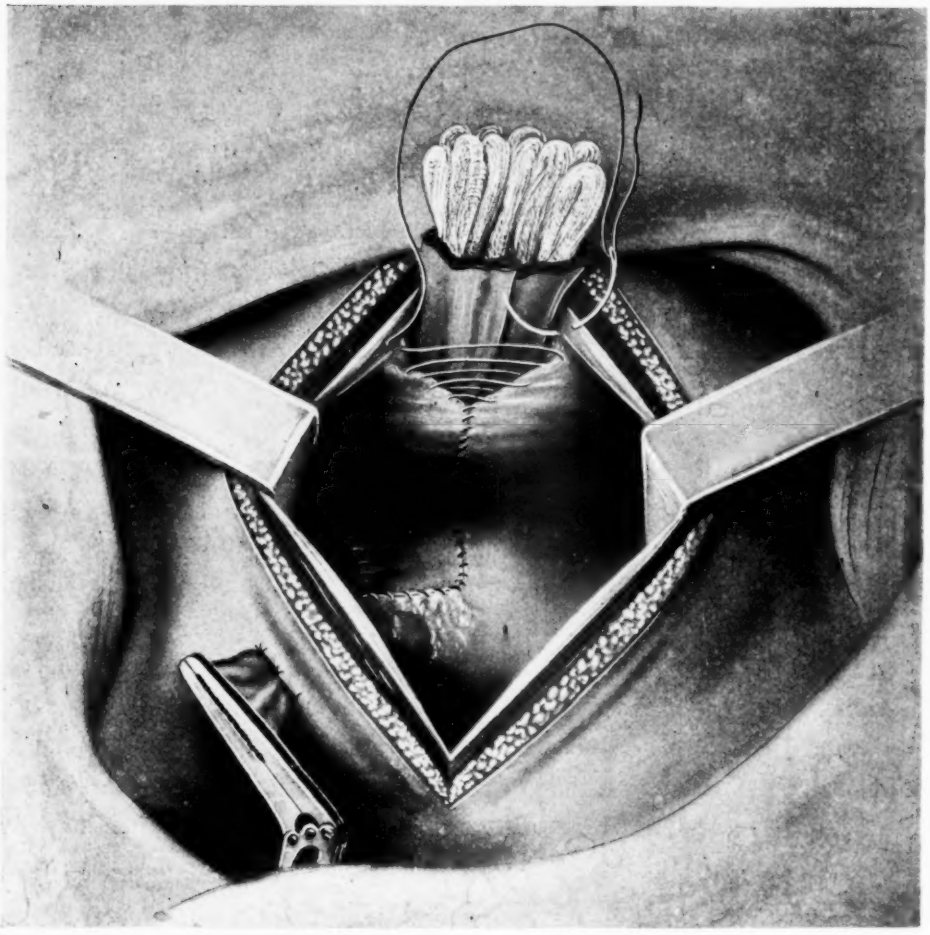

FIG. 10. After the space between the sigmoid and the left parietal peritoneum has been closed by suture, a continuous catgut is run along the mesosigmoid covering the raw fat edges with peritoneum down to the upper portion of the cul-de-sac, where drain is inserted. The suture line continues to bring the parietal peritoneum from the sides of the narrow pelvis around the drain until the abdominal incision is reached, making the drain extraperitoneal.

to bring in the peritoneum of the lateral walls of the pelvis snugly around the drain. This suture continues forward until the peritoneum is closed around the drain up to the lower end

of the long abdominal incision (Fig. 10). Thus the drain becomes extraperitoneal.

At times a large portion of the peritoneum has to be removed and it is impossible to close the space with healthy peritoneum. In the presence of a large omentum, it is possible to suture the omentum to the posterior parietal peritoneum around the brim of the true pelvis at the lumbosacral prominence and to the mesocolon in such a way as to shut the intestines entirely above this omental diaphragm. Then it is perfectly safe and simple to put a large quarantine into the lower space without surrounding it with a tube of peritoneum. The intestines push the omentum down and it fits itself around the quarantine drain. At other times where much of the peritoneum has been removed on account of malignancy, a simple large pack of gauze has been placed surrounded with rubber tissue above until nature has formed her own wall. Miles has called particular attention to the type of case in which a large amount of peritoneum has been involved and therefore must be removed.

Thus all the raw surfaces and openings which would favor postoperative adhesions or postoperative obstruction have been closed, the devitalized tissue has been pushed down to the field of the second operation, and separated by an extraperitoneal quarantine which also takes the place of a drain (Fig. 11). The question of passing a drain up through the rectum through a puncture in the vault of the rectum above the growth into the cavity containing the devitalized tissues, or inserting a drainage tube through the space between the rectum and the sacrum for the purpose of draining the devitalized area, was the first consideration, but experience caused me to decide in favor of the method described for the reason already expressed: that a tube does not properly drain fresh connective tissues while gauze, being capillary, drains upward even better than downward.

The original operation in woman differed from the standard operation just described in two points:

1. When the time came to place the quarantine, a long forceps was passed into the vagina, a hole was made in the posterior fornix through the septum into the cul-de-sac. Enough

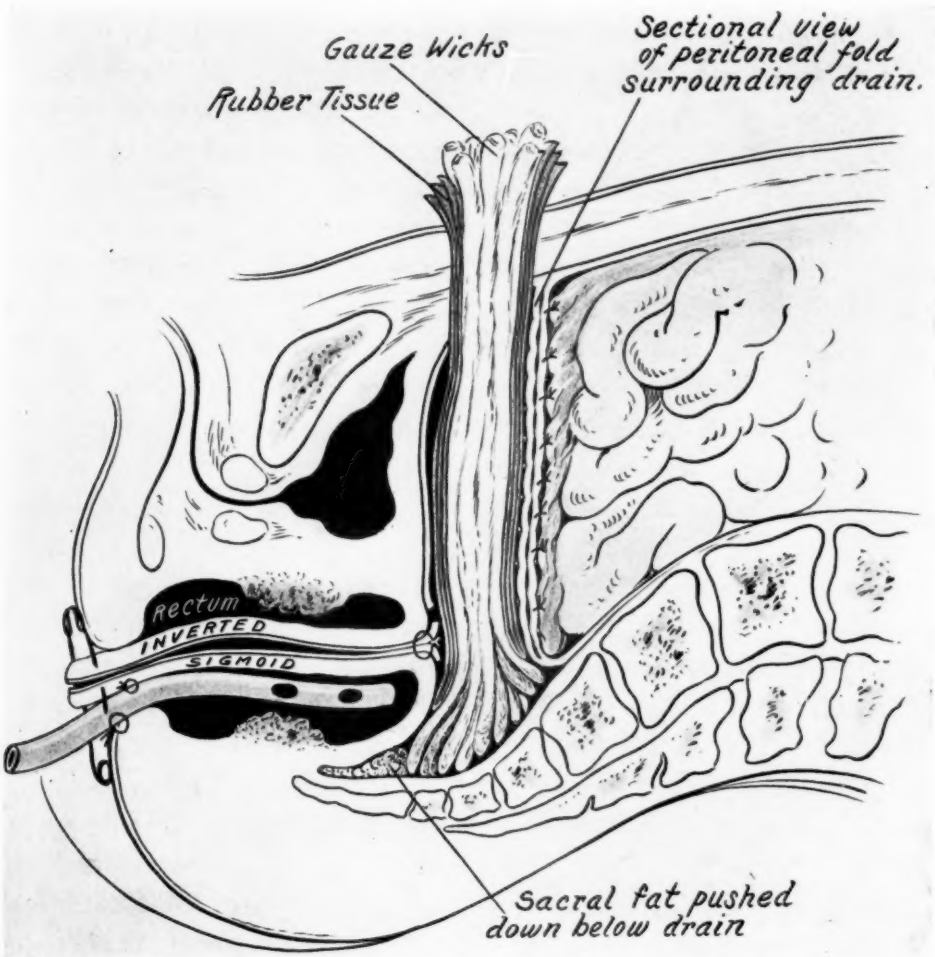


FIG. 11. Sectional view of drains which have been enclosed in a tube of peritoneum drawn in from the pelvic wall. Fat in hollow of sacrum is pushed down, a drainage tube in rectum and inverted sigmoid held down by a safety pin. Omentum has been sewed to the line of peritoneal sutures to add extra strength.

wicks to make a roll of gauze an inch or more in diameter were put in the grasp of the forceps and drawn out through the vagina, leaving enough of the wicks inside the cul-de-sac to turn over the end of the inverted rectum into the hollow of the

sacrum and coccyx where it was to form a quarantine, and was also to serve the purpose of a drain.

2. The uterus may be turned backward into the hollow of the sacrum and sewed around to the parietal peritoneum for the purpose of making a good abdominal floor and an intact peritoneal cavity or it is very easy to use the pelvic peritoneum back of the uterus.

Experience proved that when this technique of drainage was used in women, the sepsis was always greater than was noted in men where a large amount of gauze drainage was brought out through the lower wound, so we have practically abandoned vaginal drainage and have adopted the massive protected gauze wick pack coming out through the lower angle of the abdominal incision in women as well as men.

Having completed the vital parts of the operation, the large abdominal incision is closed, the Payr clamp on the protruding end of the sigmoid is removed and a Kocher forceps applied in its place to hold the intestine closed until it is desired to open it. The forceps is fastened to the abdomen by adhesive tape.

For the protection of the main wound from the contents of a colostomy when the gut is opened, I have for a long time used a collodion dressing which is put on as follows: The skin between the wound is thoroughly dried with pure alcohol followed by dry gauze. A layer of gauze, one thickness, about 8 inches by 4 inches, is laid over the main wound with its edge on the skin between this wound and the colostomy wound. This edge is fastened to the skin for about an inch with collodion. A sheet of rubber tissue about the same size is laid over the gauze but not quite reaching the edge. Then another layer of gauze, the size of the first, is laid on top of the rubber tissue and its edge fastened to the edge of the first layer of gauze and the rubber tissue by more collodion. Another layer of rubber tissue is laid on top of this collodion to prevent its sticking to the gauze dressings. A roll of gauze is then laid on top of this between the covered wound and the colostomy (Fig. 12). This dressing

thoroughly protects the clean wound from the colostomy so that the wound should heal without breaking down.

The requirements of the principles laid down for the

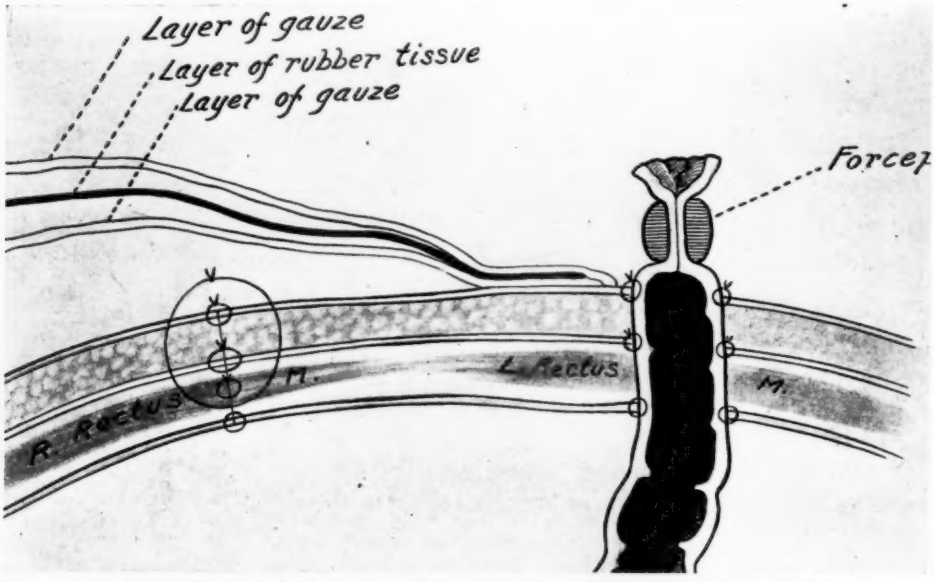


FIG. 12. Cross section of abdominal wall showing the collodion dressing and its relation to the wound and to the colostomy.

first stage of the operation having been met, the operation is halted until a complete anatomical and physiological abdominal mechanism has been re-established. By this we mean that the sutured peritoneum above the quarantine has firmly healed, the abdominal wound has healed, the artificial anus is firmly established and acting well, the patient's pulse and temperature are practically normal and the patient's digestive apparatus is functioning normally. This is usually accomplished about the tenth day after this first operation. Occasionally, we do the operation a little earlier but sometimes the second operation is delayed several days longer until the patient is in a good healthy condition. In the meantime, the cancer has been largely cut off from its support, is quarantined from the rest of the body to a great extent, and is almost harmless for the time being. The most startling and

spectacular thing that takes place during this interval between operations, is the line of cleavage between the tissues which have been devitalized and are to be removed and the normal structures which are to remain. This change makes the second operation a minor affair. In very feeble patients, we have recently used a three stage operation, the first of which is a simple colostomy. After the colostomy, the patient is allowed to be up and about for sometime before the main operation is done.

When we are ready for the last operation, we still have in place the quarantine which is allowed to remain as a landmark in doing the second operation.

The patient, if a man, is placed on an operating table which breaks in the middle. He lies on his face with both head and feet lowered in the jack-knife position. Incision is made from the center of the lower part of the sacrum down to within an inch of the anus, where it divides and surrounds the anus and all the anal muscles; any bleeding vessels may be caught with forceps; the coccyx and lower end of the sacrum are exposed; the last joint of the sacrum with coccyx is removed with bone forceps; the fingers of one hand are insinuated between the sacrum and the ischiorectal fat until the cavity containing the quarantine is reached (Fig. 13). Usually there is a good deal of pus and debris in this cavity, which is entirely ignored as harmless. The fingers are then pushed over farther around the end of the inverted rectum and above the growth and the rectum, and all are peeled out with an ease and completeness which is not believable until one has actually had the experience. In the process the levator ani muscles are exposed and removed. The usual time required for this last operation from the time of the first incision in the skin until the specimen is entirely removed is about five minutes without any necessity for hurrying.

Except around the anus and anal muscles, the bleeding is not sufficient to require the use of artery forceps. At no time is there danger of serious loss of blood. Nature for some reason

has, during the interval following the first operation, formed a line of cleavage which is very definite. The fingers follow this line of cleavage without particular care. After the rectum is out the seminal vesicles, prostate gland and bladder are in plain view. The clean cavity left after removal of the rectum in this way is very surprising. The large wound is now packed with gauze to absorb the fluids and control oozing. If the patient is anemic or in the least shocked, blood transfusion should be used freely.

In woman, for the last operation, the Murphy method is used. The vaginal mucous membrane and perineum are incised down to the rectal wall. If the growth is located on the posterior wall of the rectum, the mucous membrane of the vagina is simply lifted and allowed to remain. If the growth is in the front wall of the rectum, the posterior wall of the vagina is removed with the rectum. After this incision in the vaginal wall is made, the fingers of the left hand are passed through into the drainage cavity, made to curve around the inverted rectum, follow down past the coccyx and peel out the growth with the rectum and the muscles around the anus, which are cut as far distal to the growth as possible. The perineum may be partially sutured.

This inversion operation is not applicable to cancer of the rectosigmoid, and is not applicable in those cases of cancer of the rectum in which the growth has progressed to the stage of actual obstruction, for the reason that the sigmoid cannot be inverted through the growth. This type of operation not only has made cancer of the rectum one of the most hopeful cancers of the body but has reduced the mortality to a very low rate as shown by the foregoing statistics.

The first attempt to apply the principles of this type of two stage operation to the rectosigmoid cancer was in 1922.[9] It differed from the operation for cancer of the rectum proper in that the sigmoid could not be inverted through the anus. Therefore, the growth was removed at the first operation.

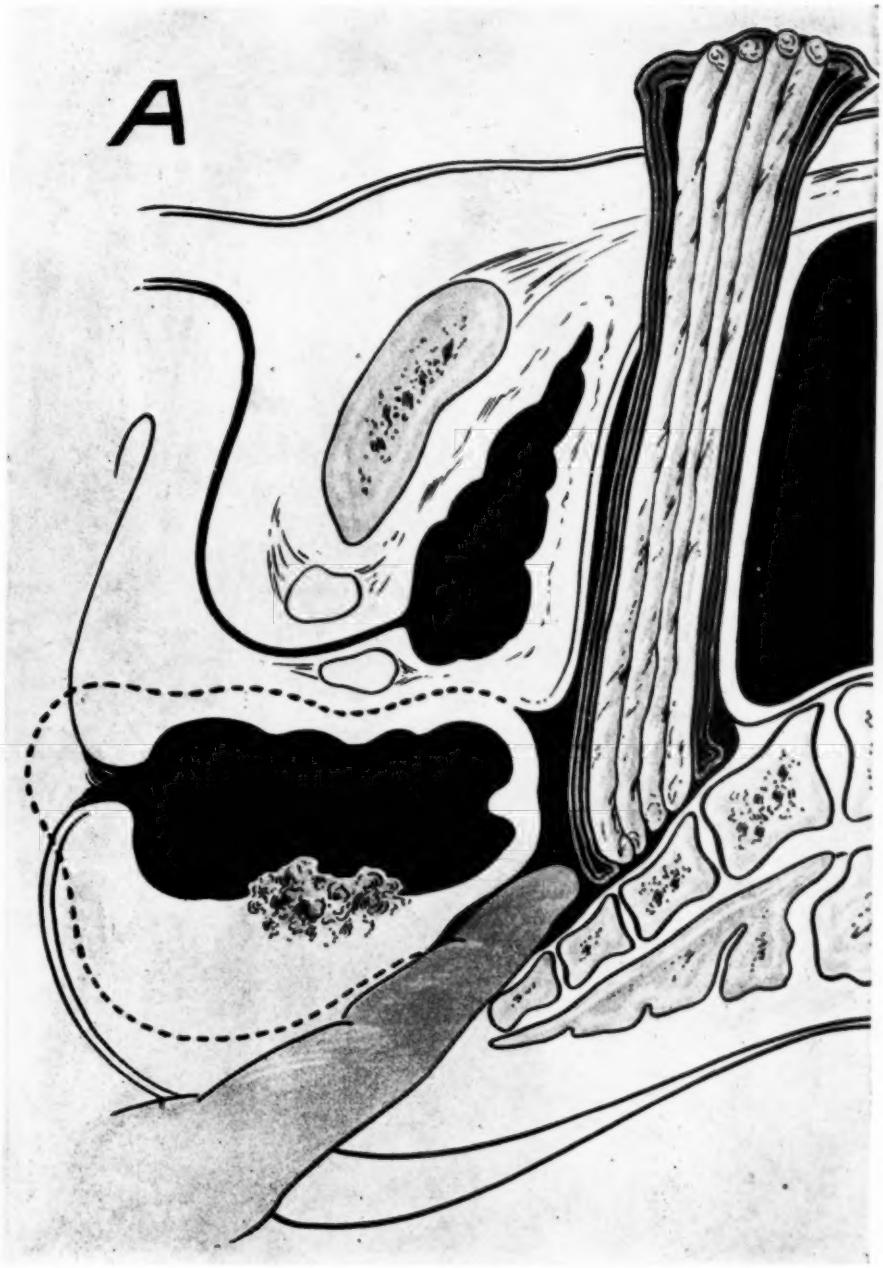


FIG. 13A.

FIG. 13. Second step of the operation. The coccyx and last joint of the sacrum are removed and after an incision is made around the anus to include the anal muscles, the fingers easily enucleate the rectum without hemorrhage (A and B), leaving a large open cavity to heal by granulation (C).

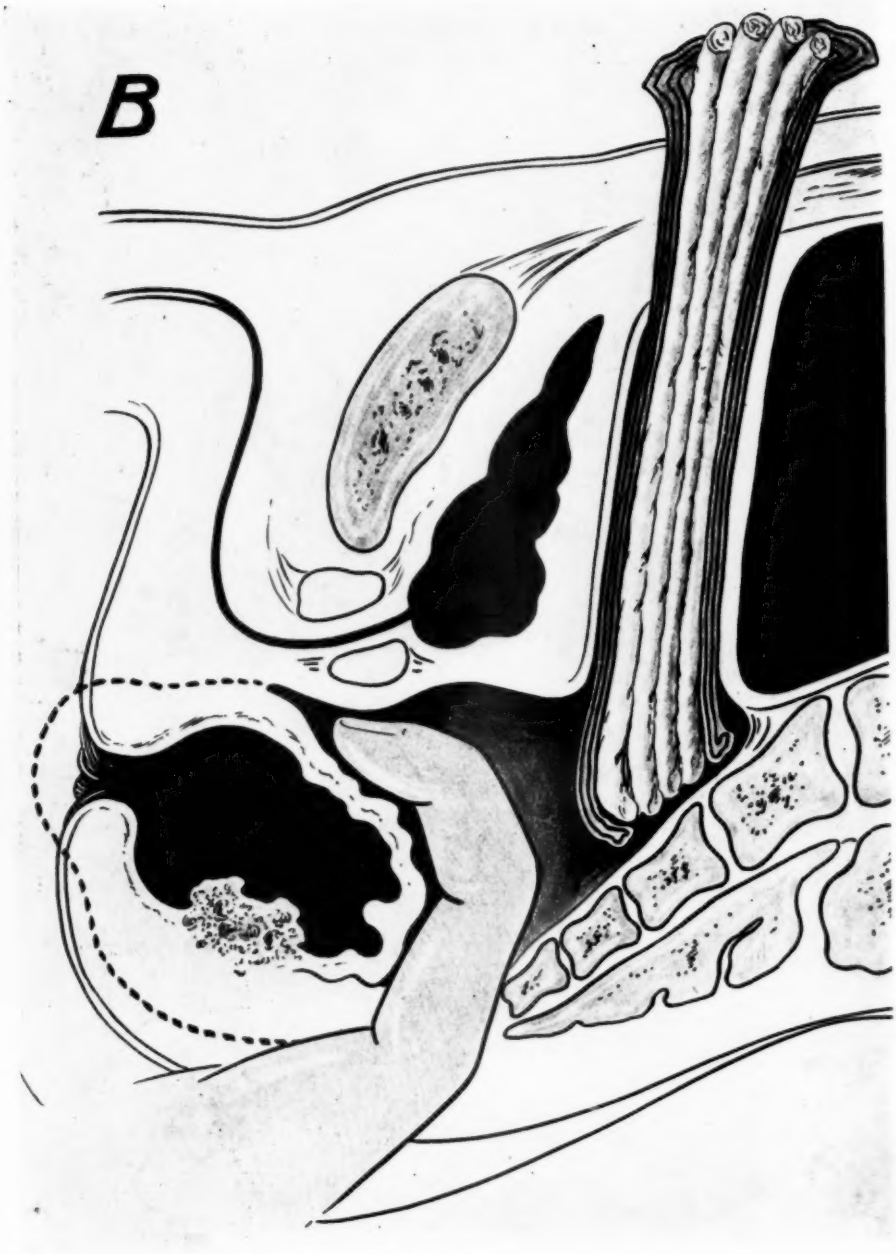


Fig. 13B.

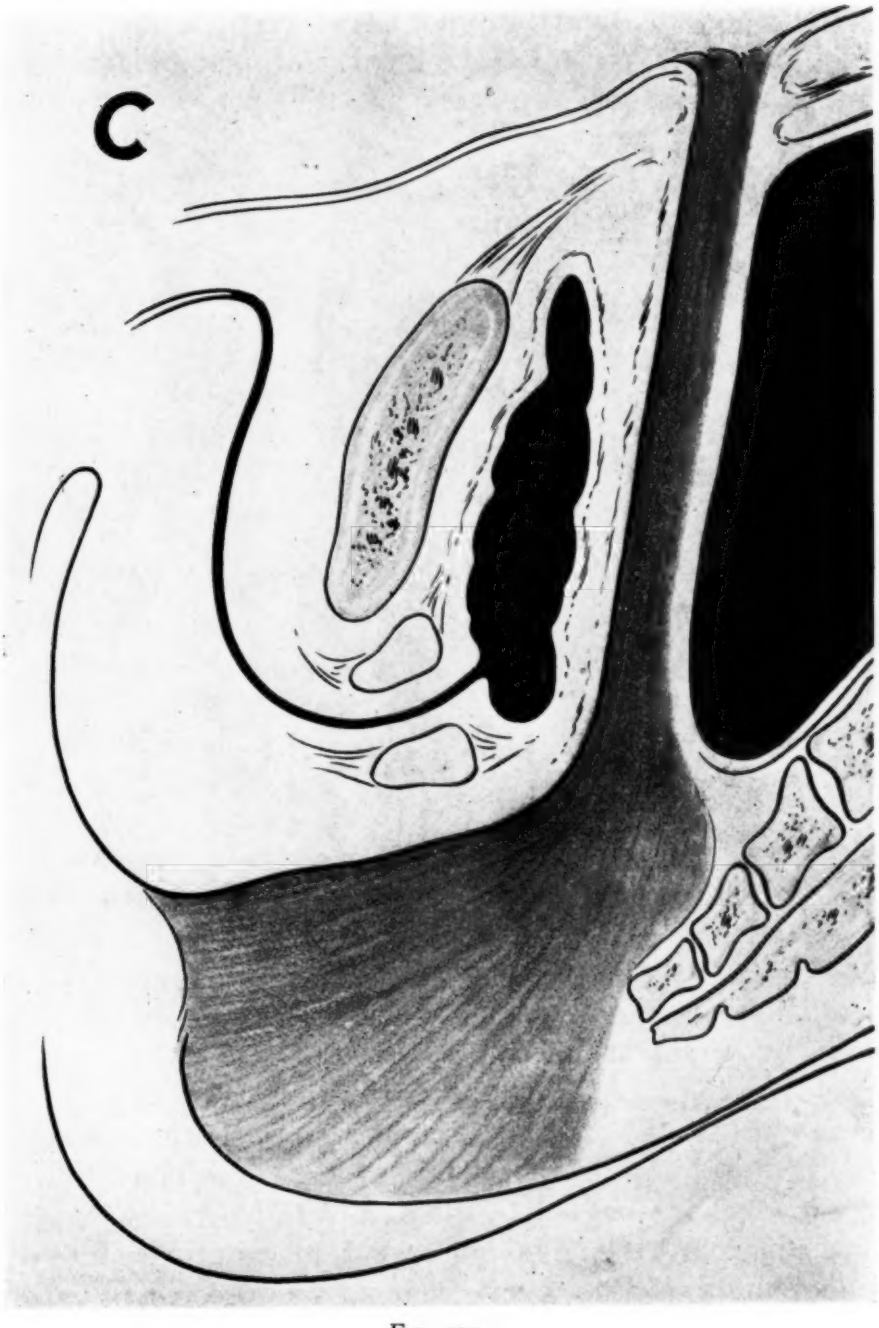


FIG. 13c.

This operation for rectosigmoid cancer performed in two stages presented no greater difficulty of manipulation and required no more technical skill than the operation for cancer

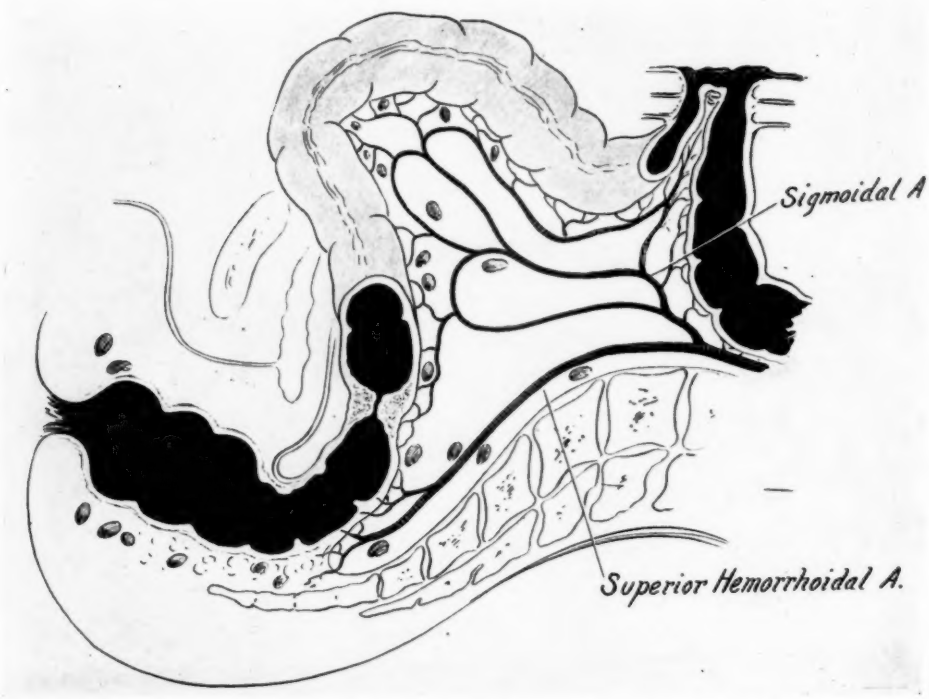


FIG. 14. Preliminary colostomy for cancer of the rectosigmoid which is left open from two to four weeks before the two-stage operation for removal of cancer of the rectum is begun.

in the ampulla and yet the mortality was more than twice as great. Gradually, it was observed that in cases where an emergency colostomy for rectosigmoid obstruction had been done by the family doctor some weeks or months previously (Fig. 14), the mortality was no greater than followed operation for cancer of the rectum. In these cases with previously established colostomy, the remaining operation was divided into two further stages as follows: the sigmoid was severed below the colostomy, the proximal end turned in, and the distal sigmoid including the growth and all the mesentery of the sigmoid and fat in the hollow of the sacrum were removed (Fig. 15).

The distal stub of the rectum was either turned in or held in a clamp, the quarantine placed in just the same way as if the rectum had been inverted and drawn out through the anus

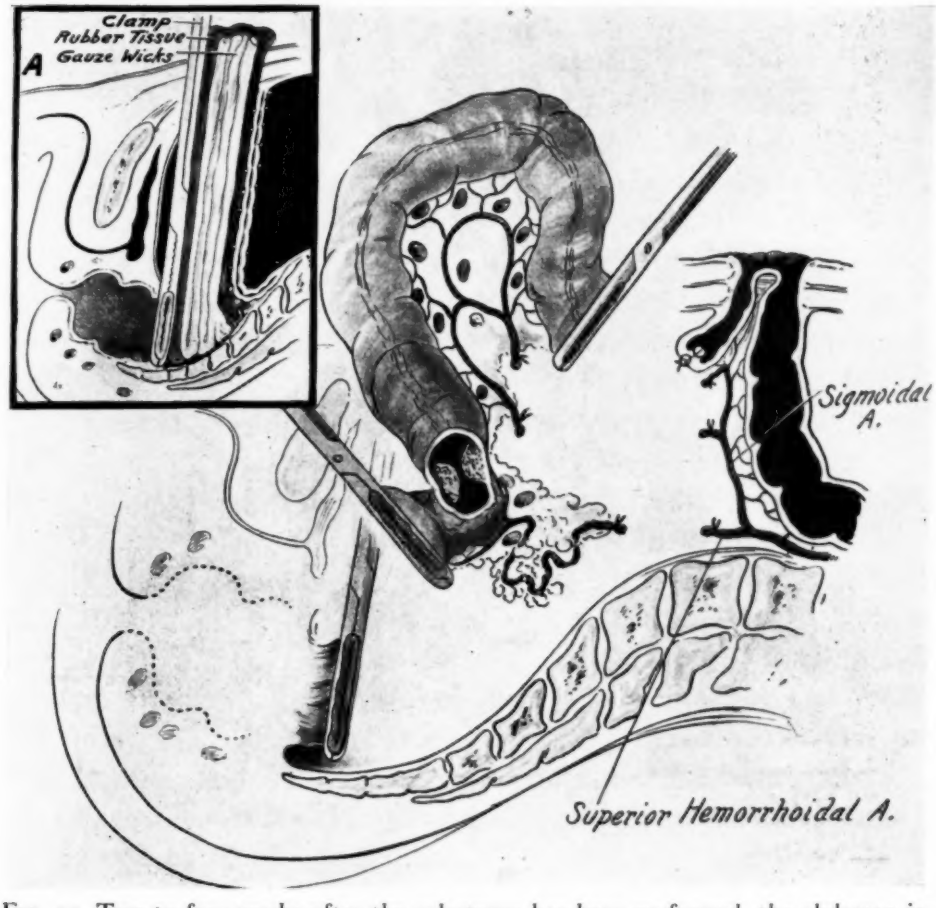


FIG. 15. Two to four weeks after the colostomy has been performed, the abdomen is opened through the right rectus, the vessels are ligated, the intestine severed and mobilized as in Figures 6 and 9, after which the sigmoid is clamped and severed between clamps below the colostomy and below the growth. The distal stub of rectum held in a clamp or inverted with a purse string, and the area drained with a quarantine pack (Insert A). The rectum is later removed as shown in Figure 13 A, B, and C.

(Fig. 15, insert A). From one to two weeks later, the remaining rectum was removed. This points to the fact that there is something to be considered in connection with cancer of the rectosigmoid that did not exist in cancer of the rectum.

Study of the preoperative histories of cases of cancer of the rectosigmoid shows that the first symptoms noticed by the patient is usually a diarrhea, which may or may not have been preceded by a noticeable constipation. This diarrhea is usually accompanied by a small amount of blood mixed with pus. The diarrhea is due to bacterial action above an intestinal obstruction. The rectosigmoid in the first place is a rather narrow segment of the bowel, furthermore it is surrounded partially by peritoneum. The growth here instead of beginning with an ulcer on one wall of the bowel and gradually extending by radial growth around it, seems to proceed to the formation of a thin, narrow annular obstructive stricture.

A gradually narrowing growth of the sigmoid or lower bowel which produces a slow obstruction, causes a reverse peristalsis and constantly throws back the fecal matter into the cecum. The cecum becomes dilated in nearly all cases and in some cases becomes enormously dilated and in a few instances reported in the literature it has been distended by obstruction in the sigmoid to a point of actually producing gangrene. A severe intestinal toxemia accompanies such a condition. This has been very forcibly brought home to me in the case of one of my very good friends. He had been my patient for several years and had been operated upon for obstruction of the common duct. One day he came in and said that he wanted to take a trip abroad and would like to have me examine him. I said, "How have you been?" His reply was, "I have been splendid but during the last three weeks I have noticed a diarrhea and I would like to see what can be done about it." A patient past sixty years of age who has been in good health and never subject to bowel disturbances who suddenly begins to have diarrhea which is persistent and with which is a certain amount of gas pain in the abdomen, becomes the subject of grave concern. In a very large percentage of cases the diarrhea is produced by an obstruction in the pelvic colon and this obstruction at this age is nearly always cancer. He was placed on the examination table and there was felt

an obstructing carcinoma at the rectosigmoid junction. I urged him to lose no time in coming to the hospital. An attempt to clear his bowel with cathartics was only par-

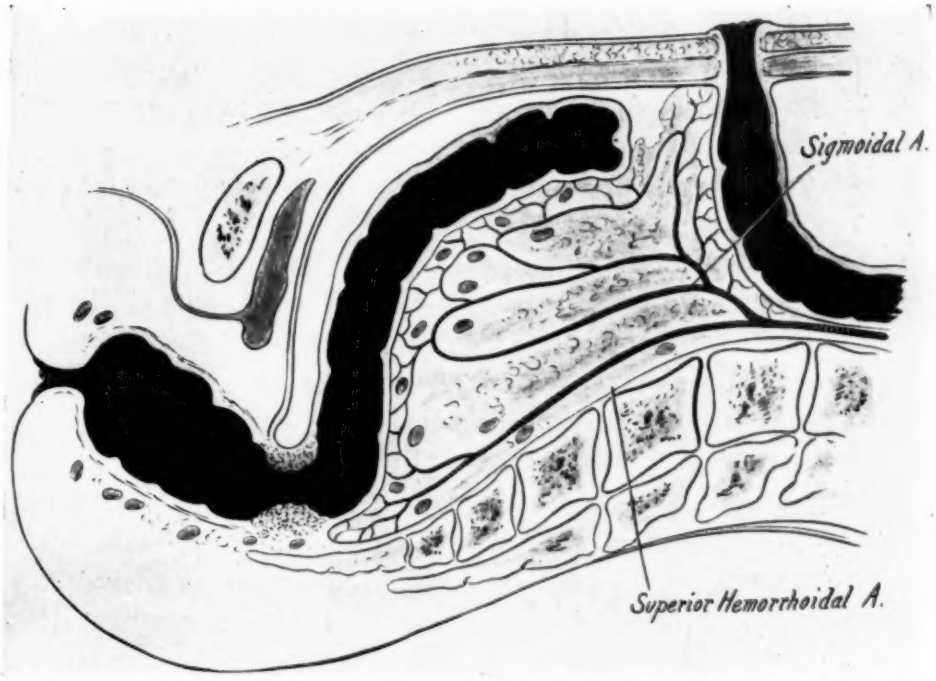


FIG. 16. If the obstruction is not complete, it is sometimes well to sever the sigmoid and drop the inverted distal segment back into the peritoneal cavity as a part of the colostomy operation.

tially successful. At the chosen time, an incision was made in the left rectus muscle for the purpose of doing a colostomy. A loop of bowel was brought up through the incision for a colostomy. Two days later, the bowel was opened with the cautery. Relatively a small amount of gas and fecal matter escaped and some relief was obtained, but the abdomen still remained distended and the patient developed hiccough and a certian amount of vomiting. The abdomen was then opened high up with a median line incision in the expectation that we would probably find a loop of small bowel which was obstructed. Instead we found an enormously distended cecum with a certain amount of distention of the transverse

colon. The cecum was so located that it would not be brought into the wound without making another incision. Therefore, the transverse colon was brought into the wound and fastened where it was left for a few hours and then opened and a tube was passed upward and a considerable amount of gas and fecal matter escaped through the tube, but it did not completely drain the cecum, and the patient died on the fourteenth postoperative day.

Since that time, I have done no operation for cancer of the rectosigmoid until a functioning colostomy has been thoroughly established and the patient has been restored to entirely normal gastrointestinal habits. Usually the patient is allowed to get up for a few days or weeks before the radical operation is performed. Another precaution which I have always taken since that time is to examine the cecum carefully. If the cecum is distended, it is brought through the right abdominal wall for a possible cecostomy. If no trouble develops and the colostomy on the left side functions perfectly after being opened, the abdominal wall is allowed to heal over the segment of cecum without opening it. If the colostomy does not empty the bowel properly, the cecum is also opened. In short, an attempt is made to bring these patients to the stage of the patient who has had his colostomy done elsewhere and has come for the radical operation. It is hard to bring ourselves to a full realization of the importance of allowing sufficient time to elapse between the colostomy and the first radical operation. As a matter of fact, the patient should be allowed to be up and around until he has established a perfectly normal gastrointestinal function and has attained his normal state of health. This method of dealing with these cases not only relieves the patient of toxemia resulting from a chronic intestinal obstruction but also establishes a functioning abdominal mechanism which does not need to be disturbed as a result of the major operation. This I think is one of the most fundamental principles connected with gastrointestinal surgery. I have heard a number of important surgeons of wide experience make the

remark that they had never known a death from pylorectomy after a preliminary gastroenterostomy had been thoroughly established. So far, in my own experience I have never known a death under similar circumstances. Similarly, I have so far not had a death in removing a cancer of the rectosigmoid where a functioning gastrointestinal mechanism had been established through a colostomy wound, and the patient had been allowed to get up and around before the second operation was done.

The principle set forth in this discussion accounts for the mortality which so unexpectedly and frequently happens after we have done a perfectly ideal resection of a simple annular carcinoma of the sigmoid colon followed by a perfect anastomosis. In other words, in discussing the subject of our paper, one is brought to realize that cancer of the rectosigmoid must be dealt with according to the principles of surgery of the large intestine higher up instead of the principles governing the operation for cancer of the rectum.

It is a growing belief among experienced surgeons that a one stage operation for cancer of the colon is rarely, if ever, justified for the reason that we here are dealing with toxemia of intestinal obstruction in addition to the growth itself. This obstruction must be treated before a serious operation can be contemplated. No more striking illustration of this has been published than the recent statistics of Professor George Grey Turner.[10] He reports his entire experience with cancer of the colon with radical surgery. He makes a mortality report on 142 cases as follows:

> Seventy of the cases were operated on in one stage with 18 deaths (25.71 per cent); whilst 72 were done in two or more stages with 9 deaths (12.5 per cent). In 62 cases there was a preliminary caecostomy or colotomy, and in 10 there were preliminary anastomoses. The mortality of the one-stage operations is the more to be regretted because they probably include most of the cases where the local conditions were the more favorable for removal.

The most important point in this masterly paper is that in cancer of the colon we are usually dealing with intestinal

obstruction and that the toxemia of intestinal obstruction more than doubles the risk of the operation, and must be dealt with before any thought of removal operation is contemplated. It would seem that there is no surgeon who can reliably determine those cases of obstructive cancer of the colon which he may safely do at one stage. Every surgeon of large experience has had his share of tragedies if he has attempted to do ideal resection in all cases where the simple mechanics of the situation seem to justify it. In view of the fact that no man can determine the cases he may safely resect, the only safe method is to make all operations for cancer of the colon, with rare exception, two stages or more. May it not almost be said that to do a radical resection for an obstructing cancer of the colon, which includes cancer of the rectosigmoid, without preliminary establishment of a functional intestinal mechanism and complete relief of toxemia is little short of malpractice.

## CONCLUSIONS

Cancer of the rectum and rectosigmoid constitutes approximately twelve per cent of all the cancers that afflict the human body. Cancer of the rectum and rectosigmoid, because of its anatomical location, and the accessibility of its lymphatics, is one of the most curable of cancers. The operability as cases come to the intestinal surgeon is approximately fifty per cent. Of the operable fifty per cent, approximately fifty per cent are susceptible of five year cures. There may be a few surgeons of such phenomenal skill in this special branch as to enable them to do the one stage operation with a passable mortality but they are so few as to be exceptional. In view of the fact that this is a final life and death contest and that we are therefore not particularly concerned with time or convenience I am unequivocally committed to the multiple stage operation as a routine procedure, with only rare exceptions. Because of the almost uniformly good results in cases coming for operation after a preliminary colostomy has been performed elsewhere as

an emergency operation, as well as in my own practice, and because such amazing results have been reported by Professor Grey Turner and others as to the difference between the multiple stage operation and the one stage resection operation for cancer of the colon, I have become firmly convinced that the two stage radical operation should be preceded some weeks before by a simple colostomy in all cases of rectosigmoid cancer; also in all cases of cancer of the rectum in the aged and handicapped patient. If it is good for the handicapped patient, why is it not also good for the good-risk patient? Based upon these conclusions, the following plan of operation for cancer of the rectum and rectosigmoid seems feasible, and has of late been adopted in our Clinic for most cases:

A long left rectus incision is made about the middle of the rectus muscle, the lower end of the incision extending about two inches below the umbillicus. Through this incision, careful examination of the liver and other parts of the abdomen is made for metastatic growths. The pelvis is carefully examined to determine the extent of the growth. If the patient has had diarrhoea for some weeks as a result of actual obstruction and if a distended cecum is present, the cecum is brought into the abdominal wall and fixed in a convenient place for a cecostomy in case it is needed. Hendon's[11] enterostomy technique is probably the simplest.

The uppermost movable portion of the sigmoid is brought through the lower end of the incision which is located conveniently for the wearing of a colostomy bag. (Occasionally, the mesentery of the sigmoid is fat and short so that it is very difficult to get the sigmoid into the wound. In such a case it is sometimes advisable to use the transverse colon.) The wound is then closed above leaving a loop protruding through the lower end of the incision. If the fecal contents pass through the loop and bowels act without too much distress, the colostomy is not opened for a week or ten days in order that the wound may be healed without infection from intestinal contents. Before it is opened, the wound above is covered

with a collodion dressing or rubber tissue fastened over the wound and with rubber cement. The patient is then permitted to get up and around for a few days until bowel action has become normal and patient is in a good state of health as manifested by increase in weight. When the patient's condition is good, the major stage of one of the operations described in the preceding pages, is performed, the type depending on whether or not the cancer is at the recto-sigmoid junction or in the ampulla of the rectum. The rectum and anal muscles are removed a week or ten days later as the last stage.

## REFERENCES


1. Miles, W. E. The pathology of the spread of cancer of the rectum, and its bearing upon the surgery of the cancerous rectum. *Surg. Gynec. Obst.*, 52: No. 2 A, 350 (Feb.), 1931.
2. Mayo, W. J. The radial operation for the relief of cancer of the rectum and recto-sigmoid. *Ann. Surg.*, 56: 240–255 (August) 1912.
3. Coffey, R. C. The major procedure first in the two-stage operation for relief of cancer of the rectum. *Ann. Surg.*, 61: 446–450 (April) 1915.
4. Jones, D. F. A two-stage combined abdominosacral operation for carcinoma of the rectum. *J. A. M. A.*, 65: 757–764 (Aug. 28) 1915.
5. Miles, W. E. et al. Discussion on surgical treatment of cancer of the rectum. *Brit. M. J.*, 2: 730–742 (Nov. 13) 1920.
6. Lockhart-Mummery, J. P. Two hundred cases of cancer of the rectum treated by perineal excision. *Brit. J. Surg.*, 14:.
7. Rankin, F. W. Colostomy and posterior resection for carcinoma of the rectum. *J. A. M. A.*, 89: 1961–1966, 1927.
8. Jones, D. F. End results of radical operations for carcinoma of the rectum. *Ann. Surg.*, 90: 675–691 (Oct.) 1929.
9. Coffey, R. C. Treatment of cancer of the rectum. *Ann. Surg.*, 76: 500–514 (Oct.) 1922.

   Principles of the operation for carcinoma of the rectum. *Surg. Gynec. Obst.*, 38: 723–738 (June) 1924.
10. Turner, G. G. Cancer of the colon. *Lancet*, 1: 1017 (May 18) 1929.
11. Hendon, G. A. Simple Enterostomy Technic. *Ann Surg.*, 94: 156, 1931.

# INTESTINAL OBSTRUCTION

## FROM CONGENITAL DEFORMITY OF THE SMALL INTESTINE*

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THIS clinical case we believe deserves to be published because of its rarity, since we have not found any similar case in the literature, and it is the more notable since in the act of surgical intervention we found ourselves confronted by a very grave problem of whether it was preferable to close the abdomen and condemn the patient to die of intestinal obstruction or better to extirpate all of the small intestine, thus exposing ourselves to the serious consequences of the lack of this intestine which plays such an important part in the physiology of digestion. Between immediate death from intestinal obstruction and the probable but more remote death of our patient, we elected the extirpation of the whole small intestine, depending on physiological aid from the large intestine. I do not know what procedure another surgeon would have followed. I thought that choosing the only route that nourished a real hope would work well.

### CLINICAL CASE

M. P. C. Entered Santa Cruz Hospital on November 10, 1921 in my surgical service, occupying bed No. 28 in the St. Joseph Ward. She was thirteen years of age, a native of Sans and the neighborhood of Badalona.

Parents dead. One sister healthy.

Past history: Measles, typhoid and smallpox. She had her first menstruation three months before, four days' duration, twenty-five day interval, painful. Polyuria. She used to work in a factory and her condition was normal until two months before when she suffered a sharp pain in the right iliac fossa, accompanied with chills, vomiting and constipation. Her condition returned to normal, the former syndrome reappearing three weeks later and with greater intensity. There remained after this attack pain in the right iliac fossa. These attacks of pseudo-obstruction repeated themselves, now finally arriving at a complete intestinal obstruction.

* Translated from the original Spanish by Dr. E. L. Faust. For Spanish text see p. 225.

FIG. 1. Congenital deformity of the intestine.

Exploration of the abdomen revealed a tumor in the middle toward the infraumbilical region, which was slightly movable in the transverse direction and completely immovable in the vertical, and completely dull to percussion. It gave the sensation that one was dealing with a definite tumor. There did not exist any sign to make one think of a lesion in the intestine; nor did there exist intestinal movements nor did the intestinal coils delineate themselves.

There was an eosinophilia of 8 per cent. Deviation of complement was negative.

The tumor was separate from the liver and from the spleen; it was not renal. It was not of the genital apparatus. All of it which was in the midline was surrounded by the large intestine. The diagnosis, although doubtful, we named as a tumor of the mesentery.

The valued opinion of Dr. Gallard who kindly studied the case decided us to intervene with all urgency, since the obstruction was becoming momentarily aggravated.

We made a midline incision from the xiphoid process to the pubis, showing the small intestine (Fig. 1) enormously distended, hard in consistency, all of the small intestine resolving itself into three loops which taken together corresponded to the tumor which was outlined from outside the abdominal wall. These three loops were surrounded by the completely empty large intestine. The superior extremity near the duodenal insertion and the inferior extremity near the cecal were explored and we noted a segment three fingerbreadths in length in the superior and five in the inferior which were completely empty, the latter being flaccid and the superior being distended, but without the hard consistency of the remainder of the intestine which gave the impression of being filled by a mass. The appendix was long. The mesentery glands were enlarged.

What procedure to follow in such a case? There remained only two solutions, to leave things as they were with absolute certainty of death by intestinal obstruction, or better still, if technically possible, to resect all of the small intestine, utilizing the superior and inferior two segments free of the lesion that was obstructing the intestinal lumen (a technique which the extreme mobility of the cecum facilitated permitting us at one time to resect the mass of the small intestine) and to approximate the terminal portion of the ileum to the upper part of the jejunum. The anastomosis was performed with two sutures, a sero-serosa and the other internal or perforating, the above union being protected by an omentoplasty. We ended by carefully suturing the mesentery (see Figs. 2 and 3) and removing the appendix.

The distance in the sectioned mesentery between the beginning of the jejunum and the end of the ileum was 15 centimeters, the length of all of the resected small intestine being 60 centimeters instead of the 5 meters,

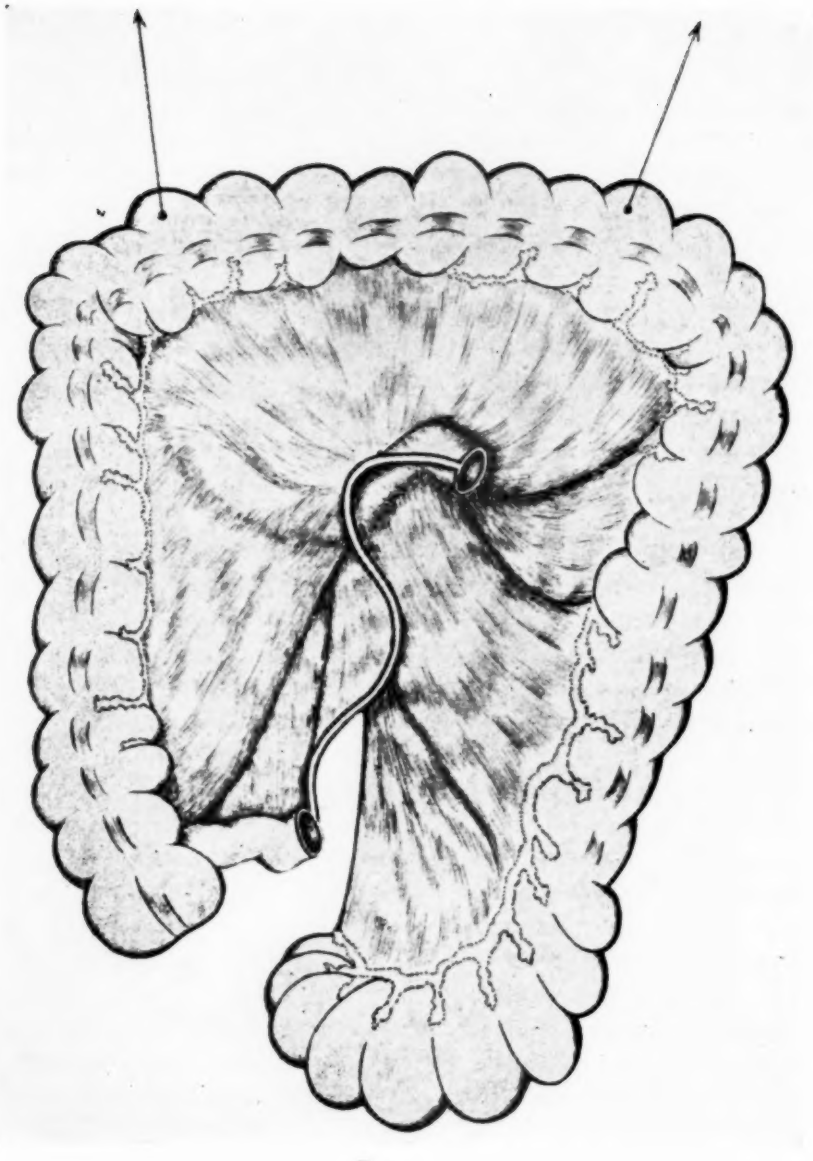

FIG. 2.

FIG. 3.

80 centimeters, to 7 meters, 80 centimeters which normally exist (Testut). We sutured the abdominal wall in three planes. The postoperative course was good.

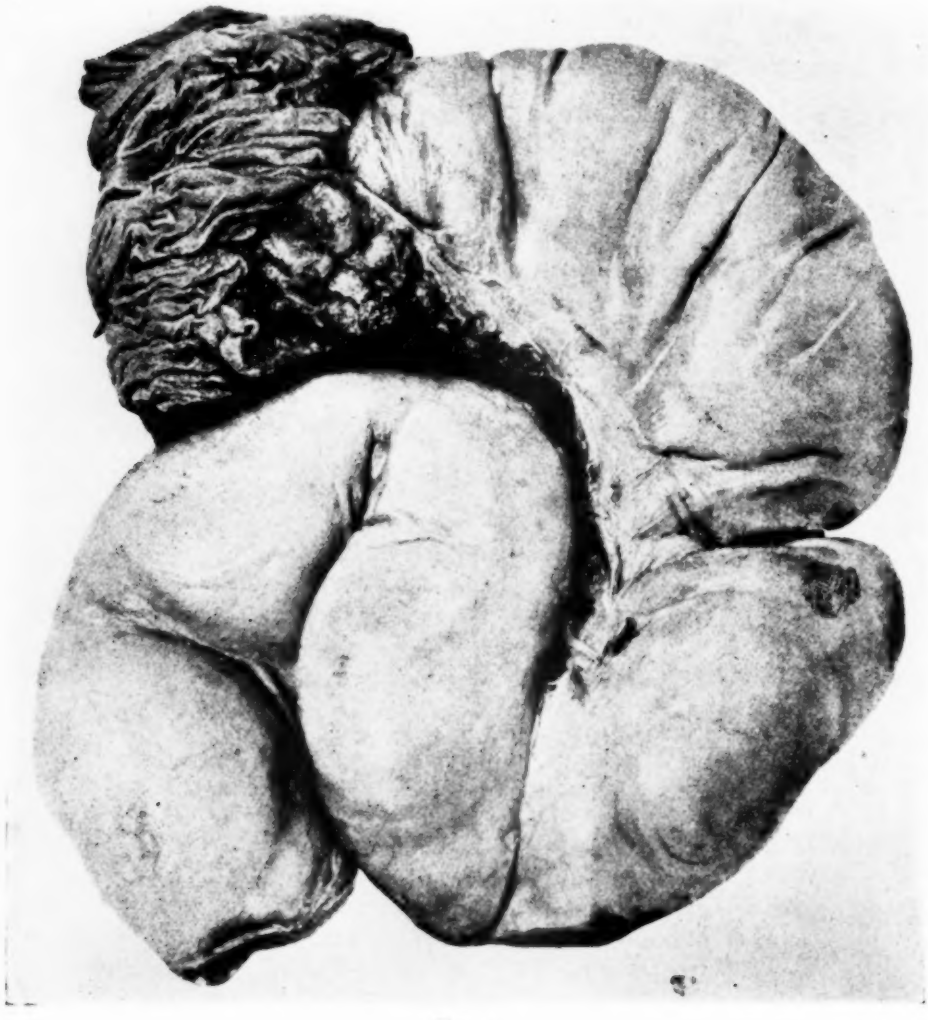

FIG. 4.

The pathological specimen consisting of three intestinal loops was of a hard consistency and without intestinal lumen; in order to enlighten ourselves as to the cause of the obstruction we excised longitudinally the superior or jejunal end and with surprise saw that it was the intestinal mucosa (Fig. 4) itself which was filling the lumen.

The impression that this produced was that in the growth of the intestine the external coats suffered an interruption in their development while the internal or mucous coat continued its growth and development,

FIGS. 5 and 6. Study no. 509. Intestine. M. P. C.

FIG. 5. View in general of one of the multiple intestinal villi. 1, Intestinal lumen. 2, Cylindrical epithelial cells of the coat, completely normal. 3, Connective axes of the villi. 4, Lymphatic follicle (corresponding identically to the Peyer's patches of the normal intestine).

thus obliging the external tube formed by the serosa and muscularis to contain all of the mucosa which continued its normal growth until the time came when it completely blocked the intestinal lumen, causing the obstruction which necessitated surgical intervention. In Figures 5 and 6 can be seen the histologic preparations made by Dr. Fornells; aside from the slight sclerosis of the wall and muscular coat irregularly distributed, there existed a complete normality of the intestinal rugae and mucous patches.

Dr. Gallard arranged the postoperative regime and made repeated analyses which we give below.

The first postoperative week she took only milk, presenting a profuse

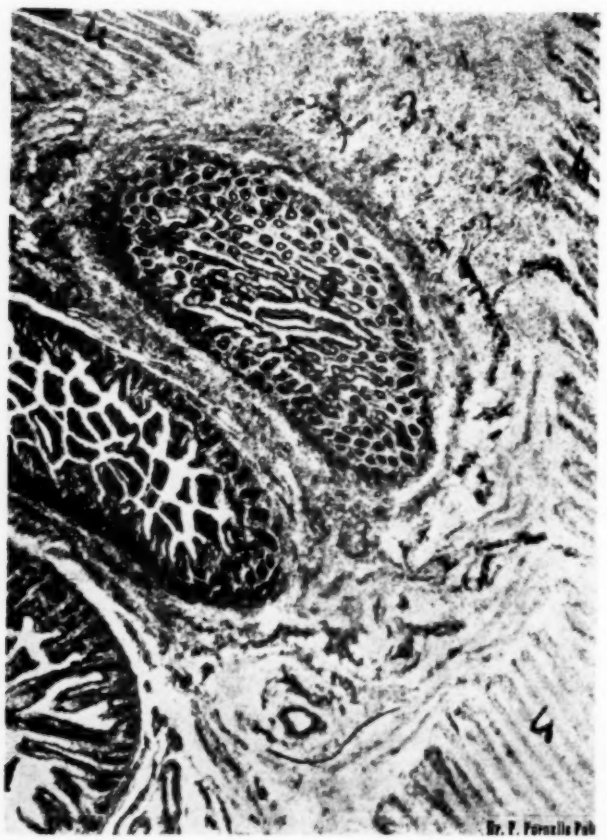

FIG. 6. Section performed on the sclerosed area in the intestinal wall. 1, Intestinal cavity (very much reduced). 2, Folds of mucosa, completely normal, which encroached on the intestinal lumen in a different plane to that of this section. 3, Fibrous connective tissue. 4, Muscular coat irregularly situated.
No tissues are found which do not correspond to the normal structure of the intestine.

diarrhea with 7 to 8 movements daily. The analysis showed an insufficiency in the digestion of fats because of rapid passage since the bile and pancreatic lipase were normal.

In the second postoperative week milk was discontinued and she was admitted to a regime of cereals which she also did not tolerate. Opium was then administered and the movements were reduced from the 7 to 8 to only 2, the greater part of the carbohydrates being digested.

FIG. 7. M. P. C., child of thirteen years, operated upon with complete extirpation of the small intestine. Fifth week postoperative.

During the third week the cereal regime was continued with some egg and chicken. She continued taking opium with a fairly good digestion of carbohydrates, poor digestion of meat with a great number of muscle fibers in the microscopic examination. The opium was withheld; the diarrhea returned.

Fourth week: Opium and hospital half ration; 2 movements daily, sometimes formed and with moderate starch and yeast but with abundant muscle fibers.

Three analysis of the gastric juice were made:

First analysis: free HCl 0.36, total acidity 2 (abundant lactic and buturic acids).

Second analysis: free HCl —0, total acidity 4.17.

Third analysis: free HCl —0, total acidity 4.

Her general condition improved visibly until the fifth week after operation as can be appreciated by the accompanying photograph (Fig. 7). in view of which she was discharged and removed to her home, being advised to follow the prescribed careful regime. According to notices received, after she was away from Barcelona, the diarrhea became more frequent and she continued losing weight and five months after operation she died with cachexia from inanition.

In spite of the very essential part which the intestine performs in digestion, they have been able to extirpate a great part of the small intestine, up to 3 meters, without the disappearance of digestive functions supervening. This clinical case demonstrates in apparent manner that even the almost total extirpation of the jejunum and ileum permits a survival more or less long, depending on the physiological reserves, the more manifest the more rigorous the regime to which the individual is submitted. In our clinical case, while she was submitted to an adequate regime and during the time we were able to watch her, she gained visibly in weight; once removed to her home and the rigorous order to which she had been submitted was disturbed, there presented themselves sufficient complications of the intestinal physiology to finish the patient, there still being in spite of it her survival for five months. One thing we ought to make clear, and that is that despite the visible improvement experienced during the three months which followed the operation, she never recovered her appetite.

# OBSTRUCCIÓN INTESTINAL POR DEFORMIDAD CONGÉNITA DEL INTESTINO DELGADO*

Dr. E. Ribas y Ribas

BARCELONA

ESTE caso clínico lo creemos por su rareza digno de ser publicado, ya que no hemos encontrado en la literatura ningún caso semejante y es tanto más notable cuanto en el acto de la intervención quirúrgica se nos planteaba un gravísimo problema y era o bien cerrar el vientre y condenar a la enferma a morir de obstruccíon intestinal o bien extirpar todo el intestino delgado y exponernos a las graves consecuencias de la falta de dicho intestino que tan importante papel juega en la fisiología de la digestión. Entre la muerte inmediata por obstrucción intestinal y la probable pero más remota optamos por la extirpación de todo el intestino delgado, y confiar en suplencias fisiológicas por el intestino grueso. No sé la conducta que hubiera seguido otro cirujano. Yo creí obrar bien eligiendo el único camino que alimentaba una esperanza.

*Caso clínico.*—Mercedes Planas Carbonell. Ingresa en el Hospital de la Santa Cruz el 10 de noviembre de 1921 en mi servicio de Cirugía ocupando la cama n.º 28 de la Sala de San José. De 13 años de edad, natural de Sans y vecina de Badalona.

Padres fallecidos. Hermana sana.

Entre sus antecedentes patológicos: sarampión, tifoidea y viruela. Hace tres meses tuvo su primera menstruación 4 por 25, dolorosa. Polaquiuria. Trabajaba en una fábrica y su estado era normal hasta hace dos meses que sufrió fuerte dolor en la fosa ilíaca derecha acompañado de escalofríos, vómitos y estreñimiento. Se normalizó su estado, reapareciendo el síndrome anterior a las dos semanas y con mayor intensidad, quedando después de estas crisis, dolor en la fosa ilíaca derecha. Estas crisis de pseudo-obstrucción se repitieron hasta llegar a la obstrucción intestinal completa.

* For English translation see p. 215.

La exploración del abdomen acusaba una tumoración media e infraumbilical, tumoración dura poco movible en el sentido transversal y completamente inmóvil en el vertical, macidez completa a la percusión. Daba la sensación de que se trataba de una tumoración. No existía ningún signo que hiciese pensar en una lesión del intestino; ni existían movimientos intestinales ni se dibujaban las asas del intestino.

Existía eosinofilia de 8%. Desviación del complemento negativo.

La tumoración dicha está separada del hígado y del bazo; no es renal; no es del aparato genital. Toda ella, que está en la línea media, está rodeada por el intestino grueso. El diagnóstico aunque dudoso lo hicimos de tumor del mesenterio.

La valiosa opinión del doctor Gallard, que estudió el caso con todo cariño, nos decidió a intervenir con toda urgencia ya que el caso de obstrucción se agravaba por momentos.

Practicamos la laparatomía media desde el apéndice xifoides hasta el pubis, poniéndose de manifiesto enormemente distendido el intestino delgado (Fig. 1), de consistencia dura, reduciéndose todo el intestino delgado a tres asas y juntas simulaban la tumoración que se encontraba detrás de la pared abdominal, dichas tres asas estaban rodeadas del intestino grueso completamente vacío. Explorado el extremo superior o su inserción duodenal y el extremo inferior o cecal se notaba un segmento de tres dedos de longitud en el superior y cinco en el inferior que estaban completamente vacíos, estando flácido este último y distendido el superior, pero sin la consistencia dura del resto del intestino y que daba la sensación de estar relleno de una masa tumoral. Apéndice largo. Ganglios mesentéricos.

¿Qué conducta seguir en semejante caso? Sólo cabían dos soluciones: o dejar las cosas tal como estaban y con la absoluta seguridad de la muerte por obstrucción intestinal o bien ya que técnicamente era posible, resecar todo el intestino delgado aprovechando los dos segmenots superior e inferior libres de la lesión que obstruía toda la luz intestinal, técnica que facilitaba la extrema movilidad del ciego, y que nos permitió una vez resecada la masa del intestino delgado aproximar el extremo inferior terminal del ileón al superior del yeyuno. Practicada la anastomosis con dos suturas, una sero-serosa y otra interna o perforante, y protegida dicha unión con una plastia de epiplón, terminamos suturando cuidadosamente el mesenterio (véanse figuras 2 y 3) y extirpamos el apéndice.

La distancia del mesenterio seccionado entre el principio del yeyuno y el terminal del ileón era de 15 cm., siendo la longitud de todo el intestino delgado seccionado de 60 cm. en vez de los 5 metros con 80 cm. o 7 metros con 80 cm. que normalmente existen (Testut). Suturamos la pared abdominal con tres planos. Curso post-operatorio bueno.

La pieza patológica formada por tres asas intestinales era de consistencia dura y sin luz intestinal; para hacernos cargo de cual era la causa de la obstrucción incindimos longitudinalmente el extremo superior o yeyunal y con sorpresa vimos que era la mucosa del intestino (figura 4) que rellenaba toda la luz intestinal.

La impresión que producía era que al crecer el intestino sufrió un paro en su desarrollo, la pared externa, continuando el crecimiento o desarrollo de la pared interna o mucosa viéndose obligado el tubo externo formado por la serosa y muscular a contener toda la mucosa que continuó su crecimiento normal hasta llegar un momento en que tapó por completo la luz del intestino causa de la obstrucción que obligó a la intervención quirúrgica. En las figuras 5 y 6 pueden verse las preparaciones histológicas hechas por el doctor Fornells y que aparte ligera esclerosis de la pared y capa muscular desordenadamente distribuída, existe normalidad completa de las vellosidades intestinales y corpúsculos linfáticos.

El doctor Gallard formuló un régimen post-operatorio e hizo repetidos análisis que a continuación exponemos.

La primera semana post-operatoria tomó leche sola presentándose diarrea abundante, 7 a 8 deposiciones diarias. El examen coprológico demostró insuficiencia en la digestión de las grasas por travesía rápida, pues la bilis y la lipasa pancreática eran normales.

En la segunda semana post-operatoria se suprime la leche y se hace un régimen de feculentos que tampoco tolera. Entonces se le administra opio y las deposiciones de 7 a 8 bajan a 2, digeriéndose gran parte de los hidratos de carbono.

Durante la tercera semana sigue el régimen de feculentos y algún huevo y pollo. Continúa tomando opio, digestión bastante buena de los hidratos de carbono; mala digestión de la carne, gran número de fibras musculares al examen microscópico. Se suprime el opio; vuelve la diarrea.

Cuarta semana: opio y media ración del Hospital; dos deposiciones al día, algunas veces formadas con féculas y levaduras en regular cantidad con fibras musculares abundantes.

Se le hacen tres exámenes del jugo gástrico:

Primer análisis: ClH libre 0'36. Acidez total 2 (láctico y butírico abundantes).

Segundo análisis: ClH = 0. Acidez total 4'17.

Tercer análisis: ClH = 0. Acidez total 4.

El estado general mejora visiblemente a la quinta semana después de operada como puede apreciarse en la adjunta fotografía (Fig. 7), en vista de lo cual se le da el alta y es trasladada a su domicilio, encargando siga el riguroso régimen prescrito. Según las noticias recibidas, pues estaba

fuera de Barcelona, las diarreas se hicieron más frecuentes, fué perdiendo de peso y a los cinco meses de operada falleció de caquexia por inanición.

A pesar del papel esencial que desempeña el intestino en la digestion, se ha llegado a extirpar una gran parte del intestino delgado hasta 3 metros en el hombre sin que sobrevenga la desaparición de las funciones digestivas. Este caso clínico demuestra de modo ostensible que aun la extirpación casi total del yeyuno e íleon, permite una supervivencia más o menos larga, debida a suplencias fisiológicas, tanto más manifiestas cuanto más riguroso es el régimen a que se someta el individuo. En nuestro caso clínico, mientras estuvo sometida a un régimen adecuado y durante el tiempo que pudimos vigilarla, aumentó visiblemente de peso; una vez trasladada a su domicilio y descuidado el riguroso régimen a que se había sometido fuéronse presentando trastornos del fisiologismo intestinal hasta acabar con la enferma, siendo a pesar de ello la supervivencia de 5 meses. Un hecho debemos hacer constar, y es que a pesar de la visible mejoría experimentada durante los 3 meses que siguieron a la operación, nunca recobró el apetito.

# CANCER IN THE NORTH AMERICAN NEGRO

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THE outstanding contribution to the study of benign and malignant tumors in the American Negro was made by Dr. Rudolph Matas in 1896, in a contribution to a treatise on Surgery by Frederick S. Dennis of New York City. Dr. Matas brought to bear upon his treatment of this interesting phase of the cancer problem an unrivalled experience, extraordinary powers of observation, and an impartial attitude of mind which gives to this production a lasting value in medical literature. I had in the same year published my "Race, Traits and Tendencies of the American Negro" including some fragmentary data on tumors, following an earlier discussion in my "Vital Statistics of the Negro" published in the Arena in 1892. But it was not until 1915, or twenty-three years later, that I was able to discuss the apparent frequency of cancer in the negro race, on the basis of more ample data, in my "Mortality of Cancer Throughout the World." But this discussion being incidental to a larger purpose was far from adequate to present the facts as they should be known and understood by all who may have occasion to come in medical or surgical contact with the negro race. For regardless of the clear-cut statement of Dr. Matas, serious misconceptions continue to prevail, as best illustrated by a discussion of "Malignant Disease in the Colored Race, with a Report of Two Cases,"[1] by Dr. August Schachner of Louisville, Kentucky.

Dr. Schachner introduces his subject with the remark that:

> Two years ago a prominent surgeon of Louisville, now residing in an eastern city, asked me among a number of others who practice surgery as to whether I had ever operated upon a colored patient for carcinoma; if I had ever seen cancer in the negro. At that time I had not. In the same

[1] *Am. J. Surg. & Gynec.* 1898–99.

conversation he said that another surgeon, perhaps the oldest in the city, stated that in twenty-five years he had not operated upon a single case of cancer in the negro. Aside from this particular instance I have frequently noticed that the impression seems to prevail rather generally that the negro is almost exempt from cancer.

Yet when this was written or said the lucid statements and data presented by Dr. Matas were available, while the statistics of the Board of Health of Louisville would readily have furnished a conclusive answer to the question raised. In fact Dr. Schachner refers to the observations of Dr. Matas, which made the statement quite superfluous and irrelevant. He himself concludes his remarks on just two cases with the admission that, "the negro does not enjoy the immunity to malignant disease which has been heretofore supposed."

The discussion following this paper throws little light upon the question under consideration. It is quite true, however, that previous to emancipation, the negro, by all the acceptable evidence available, was relatively much less subject to malignant tumors than the white race. The earliest evidence is to be found in De Sassure's "Census of Charleston, S. C." which includes vital statistics for the period 1822–48. According to this source, out of 8639 deaths from all causes among the white population, 61 or 0.7 per cent were due to cancer. Of the 11,220 deaths among the negro population, 50 or only 0.4 per cent were due to this cause. Both races, however, even for this early period show a surprisingly low incidence of malignant tumors in this section of the country, while likewise the mortality from benign tumors was only 7 for each race. Of course, the question of imperfect diagnosis must be readily admitted for this early period when cancers generally were often not recognized as such even by the best practitioners.

The next item of evidence is the medical experience of the Freedmen's Bureau, fortunately compiled and published in some detail by Dr. Robert Reyburn, Washington, 1891. In this experience there occurred 430,466 cases of disease, of which only 462 cases or 0.1 per cent were due to cancer. Out

of 18,027 deaths from all causes, only 62 or 0.3 per cent were attributed to malignant tumors, and 17 to benign tumors, a result conforming quite closely to the Charleston figures. I give some additional early data for a few cities and the state of Alabama in my "Race, Traits and Tendencies of the American Negro," concluding at the time (1896): "Tumors and cancers are less prevalent among the colored but on the increase among the population below the age of forty-five. Carcinoma uteri from which some writers suppose the negro to be exempt is prevalent though to a less extent among the colored population."

My own interest in the subject of negro mortality had been aroused by an extremely interesting essay on "The Future of the Colored Race in the United States from an Ethnic and Medical Standpoint" by Dr. Eugene B. Corson, a lecture delivered before the Georgia Historical Society, June 6, 1887. The address by Dr. Corson was probably the first systematic attempt to elucidate the pathologic divergencies of the two races and their bearing upon the future rate of increase and race maintenance.

In 1900 the Census Office published a monograph on mortality including white and colored cancer death rates of certain southern cities. During 1906–10, the average cancer death rate of Mobile, Alabama, was 84.8 per 100,000 for the whites and 59.7 for the negroes. For Charleston, the corresponding rates were 73.7 for the whites and 37.9 for the negroes, while for New Orleans the rates were 86.0. for the whites and 74.2 for the negroes, or not far from being identical.

The contrast in death rates becomes much more marked with later years, but it would be utterly hopeless to attempt a complete picture of the far-reaching mortality changes during the twenty-seven years since the Census Office reports have been published. It must suffice for the present purpose if I give only comparative rates for the two races for the year 1926, quite typical of present-day conditions. In that year the city of Mobile had a cancer death rate of 120.6 per 100,000

for the whites and 69.4 for the negroes. Charleston had a rate of 131.7 for the whites and 119.3 for the negroes, while New Orleans had a rate of 129.8 for the whites and 138.4 for the negroes. Thus the earlier conditions much in favor of the negro have largely disappeared from some of the principal southern cities typical of the negro population. Now, in some sections at least, cancer death rates for the negroes are in excess of those common to the white population.

In 1928 the United States Public Health Service issued an interesting bulletin on negro mortality from which I quote the following sentence: "Comparing white and colored curves, colored rates are higher than white up to fifty years of age and from then on are considerably lower than the white rates." But the data are somewhat conflicting when compared with those published by the Metropolitan Life Insurance Company in 1925 for the period 1911–1922. This is one of the most useful sources of information on negro cancer mortality ever issued and cannot be omitted from a discussion of the question. It gives detailed rates by divisional periods of life for all the seven principal divisions of cancer mortality. This investigation shows that the higher death rates from cancer among the negroes are limited to females for the age period under forty-five. But these figures are contradicted again by statistics published by the U. S. Census Office in 1927 according to which the rate for the negroes was less at practically all ages, with one unimportant exception, for males, but higher for colored females at all ages fifteen and over. It is difficult to reconcile these disparities which only add to the complexity of a more or less confusing situation. It may be pointed out, however, that the Metropolitan's experience with negroes is relatively limited, although fairly comprehensive for general purposes. Again the negro mortality of the registration area of 1926 does not include certain important rural sections of the South which might possibly modify the results. Combining all ages, and adjusting the rate for age and sex variations, the Census Office gives the following adjusted death rates for the two races:

white rate 93.8, colored rate 80.6 per 100,000. For males only, however, the respective rates are 81.7 for the whites and 48.1 for the colored, while for females the adjusted rate was 104.7 for whites and 109.6 for the colored. Hence the conclusion seems justified that negro females at the present time have a somewhat higher cancer death rate than white females and this applies specifically to all ages fifteen and over on the basis of the United States' experience.

In any event the conclusion is incontrovertible that the negro cancer death rate during the last generation has increased considerably and is probably not far from the corresponding increase in the white population, although it is possibly somewhat more. The next question which therefore arises is whether there are well-marked differences in the relative distribution of the cancer mortality in the different races by organs or parts of the body affected. Unfortunately the data on this phase of the problem for earlier years are too fragmentary to admit of entirely trustworthy conclusions. The earliest data are those derived from the Census of Charleston, but limited to cancer of the uterus. It appears from this compilation that out of 61 deaths from cancer among the whites, 9 or 15 per cent were carcinoma uteri, while out of 50 deaths from cancer among the negroes, 8 or 16 per cent were of this type. None of these deaths occurred, however, before 1841 among the negroes, and none of the white uterine cancers occurred before 1831. As thus measured, the susceptibility of the two races does not vary measurably for this early period, typical of conditions of slavery. Cancer of the uterus in both races in this section of the country seems to have been extremely rare.

But as I have said, all these earlier observations are of doubtful value in view of very probable diagnostic inaccuracies. I am limiting myself, therefore, to the most recent returns of the United States registration states, and shall point out the most significant divergencies in the cancer mortality of the two races. Among the males of the negro population in 1927–28, deaths from cancer of the buccal cavity formed 5 against 5.7

per cent for the whites. Cancer of the stomach and liver formed 44.0 per cent in the whites against 50.4 per cent in the negroes and cancer of the peritoneum, intestines and rectum formed 15.2 per cent among the whites and 12.9 per cent among the negroes. Cancer of the breast, which is very rare among the men in both races, formed 0.5 per cent in the negroes against 0.2 per cent in the whites. Cancer of the skin formed 3.6 per cent in the whites and only 0.2 per cent in the negroes, while cancer of other organs and parts, or not specified, formed 31 per cent in the white population and 29 per cent in the negro.

Coming now to females, the contrast is equally marked. Cancer of the buccal cavity prevailed to the extent of only 1 per cent among the whites against 1.4 per cent for the negroes. Cancer of the stomach and liver formed 30 per cent among whites against 20.8 per cent among the negroes. Cancer of the intestines and rectum amounted to 15 per cent for the whites against only 8.7 per cent for the negroes. The most marked contrast appears in cancer of the female generative organs which caused 24.4 per cent of the cancer deaths among the whites against 44.7 per cent among the negroes. I shall have occasion to refer to this outstanding aspect of the problem again. Cancer of the breast caused 18 per cent of the cancer mortality among white women against 14.5 per cent among negro women. Cancer of the skin, as in the case of males, shows a much higher proportion among white women, or 2.0 per cent, against 1.1 per cent among negro women. These are authentic results based on the total negro mortality from cancer during 1927 and 1928 of 11,587 deaths, or respectively 3588 in males and 7999 in females.

For purposes of comparison I made a like analysis of the cancer mortality of Indians but the numbers are too small for safe generalization. But I may state that of the cancer mortality of Indian women, 24 per cent were cancers of the female generative organs against 44.7 per cent for colored women. The percentage for cancer of the breast in Indian women was 10.6 against 14.6 for negro women.

Before passing to other observations it may be of interest to add a few remarks on the relative frequency of benign tumors. In 1927 in the registration states there occurred 636 deaths from benign tumors among both sexes of the white population, or at the ratio of one death from a benign tumor to every 150 deaths from malignant tumors. Among the colored population this ratio was one in 59. As I shall have occasion to point out later, benign tumors, especially of the uterus, are extremely common among negroes, so much so, that it is rare to find a negro woman over fifty years of age who has not some form of fibroid development of the uterus or generative organs otherwise.

There is thus an abundance of evidence that cancer is not only common among the negro population of the United States at the present time, but that certain types of cancer are more common among the negroes than among the whites. The official vital statistics in this respect are fully confirmed by those of the Metropolitan Life Insurance Company published by Dr. Louis I. Dublin in 1925. It is shown in this investigation that the rate of frequency of cancer of the buccal cavity is less common among negro males than among white males at ages above twenty-five, while it is more common among negro females at ages twenty-five to seventy-four than among white females. Cancer of the stomach and liver is excessive in negro males at all ages forty-four and over, and in women at all ages over thirty-five. Cancer of the peritoneum, intestines and rectum is less common among negro males at all ages, but more common among negro females at ages under forty-five. Cancers of the female generative organs are excessive at all ages among negro women, so much so, that the facts may be given in some detail. At ages twenty-five to thirty-four the white rate is 8.6 and the colored, 17.1; thirty-four to forty-four white rate 42.3, colored, 61.2; forty-five to fifty-four, white rate 83.7, colored, 104,3; fifty-five to sixty-four, white rate 105.8, colored, 136.0; sixty-five to seventy-four, white rate 120.6, colored, 146.1; seventy-five and over, white rate 113.4,

colored, 147.7. For all ages combined the white rate was 24.9 and the colored, 38.4.

Cancer of the breast is more common among negro males, prevailing at the rate of 0.2 per 100,000 against 0.1 for the whites. For the females the rate was 11.7 for the whites and 14.6 for the negroes. Here again I will give the detailed rates for females at different divisional periods of life. There were no deaths at ages under twenty-five. At ages twenty-five to thirty-four, the white rate was 2.4 and the colored, 3.6; thirty-five to forty-four, white rate 17.0, colored, 18.6; forty-five to fifty-four, white rate 38.1, colored, 40.0; fifty-five to sixty-four, white rate 51.6, colored, 61.0; sixty-five to seventy-four, white rate 73.9, colored, 89.2, seventy-five and over, white rate 105.5, colored, 128.8.

Cancer of the skin prevailed at the rate of 2.1 among white males and 0.7 among colored males. Among white females the rate was 1.6 against 0.8 for colored females. For other organs and parts, the white male rate was 13.5 and the colored rate 9.4. For females the white rate was 9.2 and the colored, 7.5. In 1925, in my second preliminary on the San Francisco Cancer Survey, I published a wealth of new material on the cancer mortality of New Orleans, differentiating throughout the two races and yielding some extremely interesting results. The investigation covered the four years 1919–1922. Unfortunately I have not as yet been able to bring that investigation further down to date. It was based on the critical examination of the original cancer death certificates furnished by the State Board of Health through the kindness of Dr. Oscar Dowling. The cancer death rate of the white population of New Orleans, as determined by this investigation for the years 1919–1922 was 125.3 per 100,000, while that of the colored population was 121.8. That of white males was 127.3 and that of colored males was 112.8. That of white females was 123.3 and that of colored females was 129.6. The detailed tables give rates by ages but it would hardly serve a practical purpose to enlarge upon this phase of the question.

The average age at death was 57.3 years for the whites against 48.1 for the negroes. For white males the average age at death was 58.1 years against 50.8 years for colored males, while for females the average for whites was 55.8 years against 47.1 for the negroes. The average known duration of the disease was 1.5 years for the whites and 1.0 years for the negroes. Of the whites, 44.3 per cent had been operated upon previous to death, but among negroes this proportion was 16.8 per cent. Among the whites, 2.9 per cent had come to autopsy and among the negroes this proportion was only 1 per cent. Of the white deaths from cancer, 33.2 per cent occurred in hospitals and for the negroes this proportion was 40.6 per cent. For the whites no ascertainable method of diagnosis was stated in 63.4 per cent of the cases and for the negroes this proportion was 77.6 per cent. Microscopical diagnosis was made in 4.4 per cent of the cases among whites, while among the negroes this proportion was 1.3 per cent. The average length of residence in New Orleans had been 44.8 years for the whites and 41.7 years for the negroes.

By specific organs and parts, the distribution was as follows, combining males and females. The proportion of deaths from cancer of the buccal cavity among the whites was 16.8 against 6.9 per cent for the negroes; stomach and liver, whites, 29.5, negroes, 31.1 per cent; peritoneum, intestines and rectum, whites 9.8, negroes 12.2 per cent; female generative organs, whites 16.0, negroes 29.1 per cent; breast, whites 8.4, negroes 8.6 per cent; skin, whites 0.6, negroes 0.5 per cent; other organs and parts, or not specified, whites 18.9, negroes 11.5 per cent.

In my third report on the San Francisco Cancer Survey, published in 1927, I give the death rates for the two races for New Orleans for the period 1919–1923 in considerable detail. I will single out a few of the most significant items (rates per 100,000 of population).

Cancer of the lips among the whites prevailed at the rate of 0.3 against a rate of 0.4 for the negroes, and cancer of the tongue 3.5 for the whites and 1.0 for the negroes. This is

extremely interesting in view of the alleged correlation of syphilis to cancer of the tongue, since it is well known that the negro race is very much more subject to syphilis and other venereal diseases than the whites. For males only the white rate from cancer of the tongue was 6.4, while for colored males it was only 1.2. Cancer of the mouth prevailed at the rate of 0.6 for the whites and 0.4 for the negroes; cancer of the jaw, white rate 1.5, negro 2.3; cancer of the throat, white rate 1.4, negro 0.2; neck, white rate 2.9, negro 0.4; face, white rate 4.0, negro 1.5; eyes, white rate 0.5, negro 0.2; nose, white rate 0.5, negro none; ear, white rate 0.3, negro 0.4; head, white rate 0.3, negro 0.2; tonsil, white rate 0.1, negro 0.2; cheek, white rate 0.3, negro, none; pharynx, white rate 0.5, negro, none; esophagus, white rate 2.3, negro 0.2; stomach, white rate 23.0, negro 23.6; liver and gall bladder, white rate 10.3, negro 9.0; mesentery and peritoneum, white rate 1.4, negro 1.1; intestines, white rate 6.7, negro 5.3; rectum and anus, white rate 2.9, negro 6.3.

For the female generative organs, cancer of the ovaries prevailed at the rate of 2.4 among the whites and 2.9 among the negroes; cancer of the uterus, white rate 32.0, negro 52.9; vulva and vagina, white rate 0.9, negro 1.1; others of this class, white rate 0.5, negro 0.4. For cancer of the breast, both sexes, the white rate was 9.5 and the colored 9.0. For women separately, the white rate was 18.8 and the colored rate 16.8. For cancer of the skin the white rate was 0.7 and the negro 0.6; cancer of the larynx, white rate 2.8, negro 0.4; lung and pleura, white rate 2.8, negro 0.6; pancreas, white rate 0.8, negro 0.4; kidneys, white rate 1.3, negro 0.2; prostate, white rate 3.0, negro 0.8; for male population only, white rate 6.1, negro 1.6; cancer of the bladder, both sexes, white rate 4.3, negro 2.3; brain, white rate 1.1, negro 0.8; bones, white rate 2.4, negro 3.4; testis, white rate 0.1, negro 0.8; penis, white rate 0.3, negro 0.6; heart, white rate 0.1, negro, none; all organs and parts combined, white rate 112.8, negro 105.0;

males only, white rate 106.0, negro 79.8; females only, white rate 119.0, negro 126.4.

My report for New Orleans includes a mass of details as to the age at death for particular organs and parts, and the known duration of the disease. But this I will not enlarge upon for the present. I regret that my investigation did not separate sarcomas from carcinomas, but that would have very much complicated the work for which the facilities were very limited. The results in a general way confirm previous investigations and clearly emphasize the higher death rates from cancer from certain organs and parts among the negroes, particularly among negro women. Upon this phase of the problem the essay by Dr. Rudolph Matas published in 1896 furnishes the most conclusive answer. Dr. Matas considers such questions as race amalgamation, environment, anatomical peculiarities, physical characteristics, and pathological characteristics. Dr. Matas' observations are based almost exclusively upon the experience of the Charity Hospital for the period 1884–1893. In my second San Francisco cancer report, I give a supplementary table of the Charity Hospital experience 1916–1923, limited to carcinomas, epitheliomas and sarcomas in the surgical and gynecological divisions, with distinction of race. It brings out certain additional peculiarities of the negro, particularly his so much higher liability to sarcomas, apparently more common in the negro than in the whites. Thus there is reported a higher death rate from cancer of the bones among the negroes in New Orleans general mortality experience. The observations by Dr. Matas on tumor formation in the white and colored races are classical but cannot be abbreviated to advantage. With reference to benign neoplasms, however, he observes: "That this is a most fruitful field of investigation for the racial pathologist is proved by the constant and unfailing reference made by all writers on the subject to the much greater tendency displayed by the colored race to the development of certain types of benign growths, such as keloid and fibroid." This statement is confirmed by other

studies of tumors in negroes, whether in this country or in Africa or the West Indies. Dr. Matas observes in this connection on the basis of the Charity Hospital statistics that:

> This clearly shows that fibroids, alone or associated with histoid elements of the same embryological derivation (mesoblast), occurred five times more often in the colored than in the white. And, curiously enough, the mortality is exactly proportional to the prevalence, and is five times as fatal in this race. The excessive mortality is due no doubt to the great preponderance of aggravated and neglected uterine fibroids which are usually admitted in the hospital in the most advanced and incurable stages of development.

Regarding malignant neoplasms, Dr. Matas gives expression to the opinion that:

> It would appear from all this and other evidence that the opinion which has long existed that the negro was formerly less liable to malignant disease, and especially as to true cancer, is founded on some ground, though it is equally certain that at present cancer affects the races in the same proportion. But our hospital statistics go further than this, and indicate a greater prevalence of cancer among the colored patients. As they faithfully represent the experience furnished by this institution, they are worthy of serious consideration.

The foregoing observation is fully confirmed by the preceding statistical analysis of the general mortality of the country, as well as the correlated mortality experience of the Metropolitan Life Insurance Company. It is only for me to add the remark by Dr. Matas that, "The summary of this table shows that sarcoma is both more frequent and more fatal in the negro."[1] To this observation I add Dr. Matas' concluding remarks which are highly significant:

> That the tendency to the formation of neoplastic tissue whether purely hyperplastic or heteroplastic is greater in the negro than in the white race.
>
> 2. That the typical mesoblastic derivatives of the adult connective tissue group are especially prone to develop in the negro.

[1] In the Charity Hospital experience, 1916–1923, out of 1307 white surgical cancer cases, 161 or 12.3 per cent were sarcomas, and out of 833 colored surgical cancer cases, 264 or 31.4 per cent were sarcomas.

3. That of this group, the fibroma and cicatricial keloid preponderate sufficiently to give to the black race a striking pathological peculiarity.

4. That the mesoblastic derivatives of the embryonal connective tissue type, i.e., the sarcomata, are also apparently more frequent in the negro, with the sole exception of the melanotic sarcomas, which are rare.

5. That contrary to the generally accepted belief, the epiblastic derivatives of embryonal type, or the true cancers, appear, statistically at least, to be even more common than in the white race.

6. That in regard to the malignant neoplasms the negro constitution has probably undergone some change under the conditions of American civilization, since it cannot be doubted that cancer is comparatively rare in the native African, rare also in the original slave population of this country, and has only become a common disease in the American negro of the last few generations. It is also probable that the conditions that are causing an increase in the prevalence of cancer among the whites are also acting with the same effect upon the negroes.

It had originally been my intention to have included in these observations some extended statistics from Africa and the West Indies, but to enlarge upon this phase the subject would carry me too far and exceed the permissible limitations of space. I have studied the cancer problem in Haiti and obtained some interesting data from that source, including the last and admirable report of Commander K. C. Melhorn, Commissioner of Health, in Haiti. This report contains some statistics of interest but of limited value in view of the large proportion of ill-defined, or not specified, diagnosed causes of death. The statement has been made that cancer is equally common in Haitian natives as it would be in a like proportion of the white population. But with this conclusion, I am entirely in disagreement. In the mortality report for 1927, for example, out of 12,868 deaths, only 47 are attributed to cancer. Of these, three were of the buccal cavity, 14 cancer of the stomach and liver, 1 cancer of the intestines, 8 cancer of the uterus, 9 cancer of the breast, and 12 cancer of other organs and parts. That cancer does occur among Haitian natives of practically every type may be readily admitted for the Haitian Hospital has an excellent personnel and makes frequent microscopical examinations of tissue. But considering the large number of

patients under treatment at the local infirmaries and dispensaries throughout the Island under American administration, the actual number of cancer cases reported is very small. The Haitian Medical Service last year furnished me with diagnostic cards for 85 patients, which as far as I know represent all that have been subjected to microscopical examination. Of these 85, 44 were males and 24 were females, while in 17 cases, the sex was not defined. Of the 85 cases, 12 were diagnosed as sarcomas, including 5 diagnosed as fibroid sarcomas. Practically almost every organ or part of the body was included in the cases under review, suggestive of the conclusion that cancer is relatively frequent in Haiti, certainly in the town populations. But concluding from my own observations of life in Port-au-Prince, I see no reason why this should not be the case for the natives of Port-au-Prince live much like the negro population of New Orleans and other large southern cities. The inadequacy of the 85 cases for definite conclusions is best illustrated by the fact that not one of the deaths was from cancer of the stomach, and only one was from cancer of the uterus, but there were 21 cases of cancer of the breast, including 3 cases in males. There were 6 cases of cancer of the penis which is said to be rather common.

I have also compiled the statistics of cancer in the Virgin Islands on which an interesting report has been published.[1] Of the deaths reported, 5.3 per cent were of cancer of the buccal cavity against 2.7 per cent in the American negro. Cancer of the stomach and liver formed 31.4 per cent in the Virgin Islands against 30.4 per cent in the American negro. Cancer of the peritoneum and intestines formed 5.3 against 9.2 per cent, cancer of the generative organs 23.7 against 30.8 per cent, and cancer of the breast 5.3 against 9.9 per cent. There were no deaths from cancer of the skin. Cancer of other organs and parts formed 28 against 15.5 per cent for the American negro. The mortality, however, is too limited, and as in the Haitian report represents probably exclusively a town population.

[1] *U. S. Naval Med. Bull.*, 20:31 (Jan.) 1924.

Before continuing with the preceding observations, I wish briefly to call attention to an interesting book on "Practical Rules for the Management and Medical Treatment of Negro Slaves in the Sugar Colonies" published by a Professional Planter, London, 1811. It contains an interesting discussion of diseases of negroes but absolutely void of any reference to malignant tumors. The writer observes that few of the medical men at the time had devoted their pens very particularly to the subject of negro disorders, which, unfortunately, is true even at the present time regardless of the large negro population of this country. For unless the negro is studied in the manner of Dr. Matas with reference to his anatomical, pathological and possibly physiological peculiarities, the subject of negro health cannot possibly reach the same status as is true of the white population. As far as I know the only strictly scientific attempt in this direction is the practically unknown treatise on "The Comparative Anatomy and Psychology of the African Negro" by Herman Burmeister, translated by Dr. Julius Friedlander and Dr. Robert Tomes, published first in the *New York Evening Post*, and subsequently republished in pamphlet form, New York, 1853. It is regrettable that such studies could not have been continued on a much larger and more comprehensive scale in view of the vastly greater material now available for the purpose. But Burmeister was concerned rather with anatomical and anthropometric variations in the two races than with pathological and physiological differences which unquestionably bear directly upon disease predisposition and disease liability.

Returning now to the occurrence of cancer among the negroes of the West Indies, I may refer to a discussion on "Cancer in St. Croix, Virgin Islands" by Dr. C. B. Van Gaasbeek, Lieutenant, M. C., U. S. N.[1] This paper is based on two and one half years' observations on the part of a qualified observer, while the statistics were obtained from the clinical records of the Christiansted and the Frederiksted Municipal

[1] *U. S. Naval Med. Bull.*, 20: 31 (Jan.) 1924.

Hospitals, amplified by the official death certificates and the writer's own observation of some of the cases. He states that:

> During the past two and one-half years, i.e., from January 1, 1921, to July 1, 1923, among the 5,720 patients treated in the hospitals on the island there have occurred 15 cases of cancer. Of these, 2 cases may safely be disregarded, since the diagnoses were evidently erroneous, and a third case was very doubtful. One case diagnosed carcinoma of the stomach proved on autopsy to be gastric ulcer. The second case was diagnosed carcinoma of the testis with metastases to the inguinal glands. In this case the testis and some of the glands were removed. The operative wound later broke down and gonococci were obtained in the discharge. This patient is living and well two years later. The third case was diagnosed gastric carcinoma on clinical signs alone.
>
> Of the 14 authentic cases of cancer, the distribution was as follows: 4 epitheliomata, including 1 of the tongue, 2 of the face, and 1 of the anus; 3 carcinomata of the breast; 5 carcinomata of the uterus; 1 carcinoma of the liver, metastasized from the head of the pancreas; and 1 carcinoma of the stomach.
>
> The age limits varied from 19 years to 87 years, with an average age of 51.1 years. The youngest was the epithelioma of the anus and the eldest was an epithelioma of the face.

With reference to the population of St. Croix, he remarks:

> The majority of people of St. Croix are negroes. They are poor and for the most part ill fed, living upon fungi and fish, and are consequently poorly nourished. Smoking has always been common. The clay pipe is generally employed for this purpose. It is probable that their physical condition, habits, and mode of living exempt them in a large extent from cancer.

Of the 14 cases, 11 occurred in people somewhat above the average of field laborers, both in living and eating. This fact would make it appear that people living under primitive conditions are relatively immune to cancer. He quotes Williams to the effect that: "Cancer was rare among people predominately poor and of necessity frugal, subsisting on an alimentation comprising but little protein food."

Referring to Pitchford's observation that "the increase in cancer is due to the diminution of protection to light and the increased exposure to illumination," he holds that dark-

skinned races on this account are less liable to malignant disease than white races in the tropical and semitropical climates. He therefore arrives at the final conclusion that,

> The people of St. Croix appear to be relatively less susceptible to cancer probably because of (1) their black color protecting them from the rays of the sun, the darker the individual the greater the protection; (2) simple diet, especially lacking in the highly seasoned protein foods; (3) lack of alcoholism; (4) non-use of powders and in many cases of soap; (5) and especially their physical conditions and modes of living.

Unfortunately Dr. Gaasbeek did not continue his study probably because of transfer to other parts. In the meantime, however, Dr. R. M. Choisser, Lieutenant Commander, M. C., U. S. N., has contributed an important study based on a review of 700 consecutive autopsies in Haiti. It was my privilege to meet Dr. Choisser in Haiti and he favored me with some of his observations. I heard his paper on the first 300 autopsies read before the Haitian Medical Society at Port-au-Prince in March, 1928. In that analysis he shows that 31.6 per cent of the deaths were due to pulmonary tuberculosis. As regards dietary habits of the peasant Haitians, he observes that as a rule they eat rather coarse, highly seasoned food and in the majority of instances imbibe freely of strong alcoholic drinks. At the same time it is thus found that these habits did not apparently predispose the native Haitian to gastric ulcer. Diseases of the liver in Haiti are rather rare. Diseases of the genitourinary system, however, are quite common. Chronic interstitial nephritis leads the list with 8.7 per cent of the total. The ratio of cases of endocarditis, both specific and non-specific, was found to be relatively very low. Passing over other diseases, I shall briefly quote some of his observations on malignancy. He remarks:

> It is the general consensus of opinion that cancer is extremely rare in people of the African race. I am thoroughly convinced from our necropsy findings and examinations of microscopic specimens from biopsies that this view is a misconception. The low mortality rate from cancer in the

Tropics is, in my opinion, due to a lack of scientific study rather than to a rarity of the disease itself. It is readily accepted, among both the laity and medical profession, that benign tumors such as keloids, lipomata, and fibromatoma, are quite common in the Tropics. These tumors are usually very large and make their presence known by their size alone. As the benign tumors are known to be common, it is only reasonable to assume that cancer should also be present. The fallacy arises not from any rarity of cancer, but from the lack of autopsies and a careful search of microscopic sections from suspicious tumors. Cancer is a universal disease and all races, whether primitive or otherwise, are susceptible, irrespective of the climate in which they live.

With some of the foregoing observations I cannot agree. In the first place, it does not necessarily follow that because benign tumors are common that malignant tumors must likewise be common. For conversely, while benign tumors are quite rare in civilized populations, malignant tumors are certainly most common and becoming more so. Nor do I agree with him that the apparent rarity of cancer in the tropics is due to the lack of scientific skill or interest in the correct ascertainment of malignant tumors. There are certainly countless localities and sections in the Tropics which for all practical purposes must be looked upon as thoroughly civilized and yet the incidence of cancer in these localities or sections is surprisingly low. Cancer is not necessarily a universal disease, but it is tending to become such as the result of modern habits of living, yet there are whole regions of the earth in which cancer is comparatively rare and in no part of the world does this apply more than the Continent of Africa. Even in Haiti, Dr. Choisser's own investigations revealed only 27 deaths from cancer in the records of the hospitals, or 3.85 of the total cases considered. Three of these were cases of sarcoma and 24 of carcinoma. Out of a series of 486 consecutive biopsies from specimens received from various parts of the Island, 75 or 15.4 per cent were found to be malignant. The cancers found in microscopic sections from tumors removed at operation were as follows; adenocarcinoma, 32; squamous cell carcinoma, 24; basal cell carcinoma, 5; pigmented melanoma, 3; non-pigmented melan-

oma, 3; lymphoblastoma, 2; and fibrosarcoma, 6. One interesting point was that in all of the cases of non-pigmented melanoma the original growth was on the heel.

I agree with Dr. Choisser that: "The above figures certainly do not show the African race to be immune to cancer, but they do suggest the possibility that the black man may possess a certain immunity to the metastatic distribution of malignant cells, a condition not found in those of Caucasian descent." But I would go further and maintain that in my judgment in primitive African races there is a comparatively very high degree of immunity to all forms of cancer, the development of malignant tumors being proportionate to the degree under which such races assimilate the habits and ways of living of races more civilized.

To the foregoing I will add a few brief abstracts from fragmentary references regarding cancer in the African negro or otherwise. Dr. N. Macvicar, in the South African Medical Record for 1925, gives an analysis of data relating to about 10,000 South African natives treated as hospital in-patients. Among these, the author found 97 cases of carcinoma, 30 of sarcoma, and 14 of tumors in internal organs not diagnosed or verified at operation or necropsy but probably malignant. Cancer of the mouth seems to be fairly common, which he also attributes to irritation caused by the various things that native men and women carry in their mouths, especially plugs of coarse tobacco. Cancer of the liver is apparently common among comparatively young men and even boys, and this it is suggested may be due to schistosome infection. On the other hand cancer of the breast seems to be rare. This the author was inclined to attribute to the fact that in their natural state Bantu women do not wear corsets and rarely do so even when they have adopted other European clothing. Further, he believes that the few natives who did wear the high ribbed corset of the last generation suffered as commonly as European women from breast cancer.

W. W. Pittsford[1] comments on the prevalence of cancer among the native races of Natal and Zululand. According to the abstract in the *Cancer Review:*

> The author states that during the four years 1906–9 there were reported 8 deaths from cancer among the whole native population (nearly one million) of Natal and Zululand, giving a crude death rate of about 0.21 per 100,000 per annum. During the same period the reported average annual death rate from cancer among the Indian immigrants was 11.9 and among the Europeans 57.5. The cancers were of the breast, liver, stomach, and glans penis; in addition, of 39 tumour specimens from living natives, submitted for examination, 18 proved to be benign tumours, 9 sarcoma, 9 carcinoma, 1 rodent ulcer, 1 intracystic papiloma of the breast, and 1 compound parotid tumour.

In the same year, Dr. E. D. Pridie writes on "Malignant Disease in Native Races of the Sudan."[2] According to the reviewer:

> The author states that among the primitive Hadenowa tribes of the Sudan, malignant disease seems to be very rare. During a year he saw in the whole Red Sea province only two cases, one of epithelioma of the vulva and the other of a malignant parotid tumour. Among the Sudanese natives generally, the commonest form of malignant disease is carcinoma of the breast, but benign tumours such as lipoma and fibroma are fairly common. These tribes live an isolated life, scattered over a wide area in dry desert land rising to 6000 feet in the hills along the Red Sea coast. They subsist mainly on the milk of camel, goat, sheep or cow, with small amounts of millet and meat. The milk is drunk cold, and the millet and meat are cooked. Constipation is very prevalent; circumcision is practiced; deficiency diseases are practically unknown, and diseases aggravated by insufficient diet are rare.

In the Annual Medical and Sanitary Report of Nigeria for 1925, published, Lagos, 1926, according to the *Cancer Review,* it is shown that:

> Among the tumours in natives recorded are: (1) a rapidly growing inoperable sarcoma of the superior maxilla and orbit; (2) sarcoma of the foot; (3) epithelioma of lower lip, in male, aged 58; (4) carcinoma of breast, in woman, aged 50; (5) inoperable carcinoma of caecum, in a

[1] *M. J. South Africa,* 1925.
[2] *Brit. M. J.,* 2: 649, 1925.

woman aged 50; (6) melanotic sarcoma of groin in a male, aged 40; (7) adenocarcinoma of both ovaries; (8) lymphangioma of face; (9) inoperable tumour of pylorus—microscopical examination at autopsy showed small-celled carcinoma difficult to distinguish from sarcoma; (10) inoperable carcinoma of cervix; (11) periosteal sarcoma of tibia; (12) basal-celled epithelial growth of cheek in boy, aged 14; (13) fibrosarcoma of jaw; (14) mixed-cell sarcoma of femur; (15) lipoma of shoulder.

Thus out of 15 cases, 6 were sarcomas, possibly 7, an extraordinary proportion, yet relatively common to African natives.

In the annual report of the Medical Research Laboratory for the year 1924, published Nairobi, 1926, according to the *Cancer Review*, it is said:

> Of great interest is the increasing number of malignant tumours from natives, almost all from natives untouched by civilization living a primitive life in the native reserves. Such observations are of value in view of recent statements both in England and America that "cancer" is a disease of civilization, brought about by modern food and that it is unknown in primitive tribes. Certainly in the past very little malignant disease has been reported among primitives, but is this not due to the scant medical attention they receive? The increase in the number of malignant tumours in the last few years in Kenya is marked and coincides with the opening of hospitals and dispensaries in the native reserves and the increased interest taken in the medical welfare of the native.

But the actual figures are so small as to justify no such far-reaching conclusions. In 1922, for example, 5 malignant specimens were received in the laboratory, 5 in 1923 and 17 in 1924, which considering the enormous native population in Kenya is wholly insignificant and not an index of relative frequency. The 17 specimens considered in 1924 included a gland from the neck, carcinoma of the stomach, larynx and breast, metastatic carcinoma of the liver, metastatic sarcoma, lymphosarcoma of kidney, spindle-celled sarcoma, large spindle-and giant-celled sarcoma, large round-celled sarcoma, and fibrosarcoma. Here again out of 17 cases, 6 were due to sarcomas which represents a proportion never met with in civilized populations. Since sarcomas, carcinomas and epitheliomas are unquestionably due to different causative factors, a clear

distinction must be made in their relative frequency, which unfortunately is not easily ascertainable even for civilized countries which publish statistics of cancer but do not give separate information for sarcoma. But all the investigations thus far made show conclusively that sarcomas are relatively much more common among primitive populations than among populations considered civilized.

The Annual Medical Report of the Tanganyika Territory for the year ending 1925, reviewed in the *Cancer Review* of 1927, contains an interesting note by Dr. E. L. Kennaway reading as follows:

> The following cases of malignant disease, verified by microscopic examination, in natives are described: (1) sarcoma of eye in child, aged 3; (2) mixed-celled sarcoma of scapula; (3) 3 cases of epithelioma supervening upon chronic ulcer of leg (this condition appears to be of rather frequent occurrence in African natives); (4) fibroscaroma of temporomaxillary joint; (5) inoperable spheroidal-celled carcinoma of breast in a Chagga woman, aged 40; (6) 2 cases of primary carcinoma of liver. Paget's disease was diagnosed in a woman who refused operation. Dr. J. H. Parry (Medical Officer, Moshi) remarks, "I do not believe that malignant disease is so uncommon as it is stated to be among the uncivilized Africans, and because of this belief many cases no doubt have been overlooked in the past. Why is primary carcinoma of the liver so common in the African when it is such a rare disease in Europe?"

I am quite ready to agree that malignant disease in all probability is more common among uncivilized African natives than is generally known or can be proved on the basis of statistics but the relative frequency in my judgment is exceedingly low while the overshadowing importance of sarcomas presenting the matter in a totally different light than the cancer problem affecting the negro population of this country.

In the Annual Report of the Government of the Gold Coast for 1925–26, according to Dr. Kennaway, occurs the following mention of cancer in African natives.

> There have appeared at various times recently somewhat erroneous statements as to the absence of malignant disease in the African native. The majority of the cases mentioned here are from the so-called "Bush

native" in contradistinction to the town bred educated African. The tumors enumerated are spindle-celled sarcoma (4); round-celled sarcoma (4); melanotic and lymphosarcoma (1 each); sarcoma of neck in children (2); carcinoma of breast (3, of these 1 in a male); carcinoma of cervix and of stomach (1 each); epithelioma of lip (3), leg (1) and penis (1); and some innocent tumors.

Dr. Kennaway in this connection observes that in connecting *Bilharzia* with cancer of the bladder the following passage from this report is of interest: "One female . . . had numerous ulcerations of the vulva. The Wassermann was negative. A tag from one of the ulcerations was then sent for histological examination and revealed the ova of *Schistosomum haematobium* in large numbers. It is possible that *Bilharzia* may account for many of these apparently venereal ulcerations." I have dealt elsewhere with the exceptional frequency of cancer of the bladder in Egyptian natives in an address delivered before the Cancer Research Society on April 16, 1930, so I will not enlarge upon this phase in the present discussion.

In the *Cancer Review* for 1927 is also a brief note by Dr. C. E. Dukes reviewing some observations of Surmont and Sava on cancer among the native races of Africa in the French Review of Cancer for the same year. He remarks:

French and Belgian doctors who have lived for long periods in Africa have repeatedly reported different innocent and malignant tumors which they have met with in their practice, and the authors have gone through some of these records (though obviously only a small proportion) and summarized them in this paper. The only conclusion in relation to cancer to be drawn from the facts reported is that all the common varieties of malignant disease known to exist among white races are known to exist also among the black.

With this conclusion I am in entire agreement except as to the relative degree of frequency. I have never maintained that cancer does not occur in primitive races, but I have always maintained that it occurs as a rare incident rather than as a matter of frequency common to the white population.

The immense divergencies in the distribution of cancer by organs and parts in native races from those called civilized are of the utmost importance. Nothing in this respect is more illuminating than the frequency of cancer of bladder in Egyptian natives due to *Bilharzia* infection. Here there is an isolated factor which accounts for a particular form of cancer not met with in the white population. Even more important is the excessive frequency of sarcoma among African natives for which thus far not a single acceptable conclusion has been advanced.

In the *Kenya and East African Medical Journal* for 1927, is a brief report on carcinoma in Africans, reviewed by Dr. Kennaway in the *Cancer Review* of 1928 as follows:

> A report of six cases. "In view of the tradition that carcinoma is very rare amongst African natives, it is always worth while to record such cases as are from time to time reported." Cases 1, 2 and 3, ulcerating epithelioma of foot, of abdominal wall, and of breast, respectively; 4, medullary carcinoma of breast (male); 5, carcinoma of nose; 6, squamous-celled carcinoma of oesophagus. In all these, microscopic examination was made. Cases 1–5 were from Coast tribes, case 6 was a Kavirondo.

In the same journal is a review by Dr. Kennaway of an address by Dr. C. F. Beyers[1] on the incidence of surgical diseases among the Bantu races of South Africa. From this review I quote the following extract with the writer's observations:

> A study of 18,000 Bantu in-patients admitted between 1921 and 1926 to the Johannesburg Hospital, which draws its patients from a population of about 200,000 of that race. The occupations of the adults are mainly those of labourer or domestic servant. The sites of the carcinomas were as follows: liver, 22; uterus, 12; breast, 11; (3 in males); stomach, 7; skin, 5; colon, 4; oesophagus, 3; bladder, 2; parotid, pancreas, pharynx, peritoneum, kidney, penis, thyroid, lung, larynx, 1 each.

Here again we have a totally different site distribution than would be common to a white population, suggestive of totally different conditions likely to foster or develop malignant growths in South African natives. Dr. Kennaway mentions

[1] *J. M. Assoc. So. Africa.* 1927.

that the author quotes four other collections of data on malignant disease in South African natives and he states that these figures agree with his own in showing "(1) a predominance of carcinoma over sarcoma; and (2) a very high proportion of cancers of the liver, which constitute in most series from 20 to 50 per cent of all cancers. Carcinoma of the uterus comes next in order of frequency among Bantus. The author concludes (1) that cancer is a rare disease among Bantus, and (2) that cancer does not appear to be more common in town-dwelling natives than among country natives." Dr. Kennaway observes that the author does not recognize that a comparison of the age distribution in Bantu and white populations is required, but in my judgment this would not very materially alter the results.

I will not further enlarge upon the foregoing type of data except to add a brief review of a discussion of cancer in primitive negro tribes by E. Maass, in a German periodical on Tropical Hygiene, Pathology and Therapeutics of Disease, 1928. The author apparently is connected with the Mission Hospital of Holy Cross Liberian Mission. The review reads that:

> The author refers to the statement, which is made repeatedly in the literature, that cancer occurs in native races only when they have come into contact with civilization and have adopted European customs to which they are not adapted. He describes, with histological diagnoses, two cases of cancer in the Liberian branch of a tribe which "has up till now had practically no contact with European civilization." (1) Adenocarcinoma of mamma with involvement of axillary glands in a woman of 40 to 45; (2) ulcerating cornified epithelioma below knee in a man of 40 to 45; recurrence in inguinal glands after excision and death from cachexia.

To the foregoing observations and statistics I am able to add some recent data for the Union of South Africa. During the year 1927, the number of deaths from cancer reported for the non-European population of the nine principal cities was as follows: The number of deaths of males from all causes was 7288, of which 101, or 1.3 per cent, were attributed to cancer. Out of 4676 deaths of females, 78, or 1.6 per cent, were from

cancer. Unfortunately I cannot correlate these figures precisely to the population affected, but for Cape Town I have some additional data. The number of deaths from cancer during the fiscal year 1926-27 was 176, of which 114 were of Europeans, and 62 of non-Europeans. Worked out on the basis of the population, this is equivalent to a rate of 102 per 100,000 for the Europeans and 63 per 100,000 for the non-Europeans. As observed in the Official report on the health of Cape Town by Dr. T. Shadick Higgins, "From the foregoing figures it will be observed that the recorded rate of mortality from this disease amongst Europeans was greater by over one half than amongst non-Europeans. In both races the usual preponderance of mortality amongst females is not seen in this year's figures." While the non-European population includes a small proportion of Asiatics this, in Cape Town at least, is not significant. The report gives the rate for 1916–26 for non-Europeans as having been 53 per 100,000, which by 1926–27 had increased to 63. The 61 deaths among non-Europeans during 1926–27 were distributed as follows: Two of the deaths were of the buccal cavity; 34 of the stomach and liver; 6 of the peritoneum, intestines and rectum; 7 of the female generative organs; 4 of the breast; 1 of the skin, and 7 of other organs and parts.

I have returns also for Southern Rhodesia for which during 1926, 12 deaths from cancer were reported for non-Europeans, of which 5 were of the stomach and liver; 2 of the peritoneum, intestines and rectum; 1 of the female generative organs; and 4 of other organs or parts. During 1927 there were 17 deaths, of which 11 were due to cancer of the stomach and liver; 1 cancer of the female generative organs and 5 of other organs or parts. In Rhodesian hospitals during 1926 the number of admissions for malignant tumors was 24 with 14 deaths, while there were 10 admissions for non-malignant tumors with no deaths. During 1927, there were 29 admissions for malignant tumors with 17 deaths and 18 admissions for non-malignant tumors with one death. Unfortunately again, I cannot give

the corresponding population with sufficient accuracy to justify the calculation of rates.

In addition to the foregoing I have carefully examined the reports on health and sanitary conditions of Northern Rhodesia for 1927 and 1928. These reports are almost entirely hospital reports and contain occasional mention of cancer cases of which I will cite the following illustrations for the year 1928. At the Livingston Hospital, out of 1386 admissions, one was attributed to cancer and 2 to non-malignant tumors. At the Lusaka Hospital out of 501 admissions, none was attributed to cancer. At the Broken Hill Hospital, out of 1622 admissions, 4 were from cancer or malignant tumors but the type is not indicated. At the Mongu Hospital, out of 557 admissions none was from cancer but there was one admission for non-malignant tumor. At the Kasama Hospital, out of 341 admissions, none was from cancer or non-malignant tumors. At the Fort Rosebery Hospital, out of 338 admissions, one was from cancer. At the Choma Hospital, out of 548 admissions, none was attributed to cancer. At the Abercorn Hospital, out of 102 admissions, 2 were for non-malignant tumor. At the Ndolo Hospital, out of 435 admissions, none was attributed to cancer or non-malignant tumors, and the same is true at the Mazabuka Hospital, where there were 866 admissions with not a single case of malignant or non-malignant tumor. At the Solwezi Hospital, out of 1041 admissions, one was from cancer. At the Fort Jameson Hospital, out of 474 admissions, 2 were for non-malignant tumors. Summarizing these results, it appears there were 8211 admissions, of which only 8 were attributed to malignant tumors and 6 to non-malignant tumors. Since all these hospitals are under European administration in which all the physicians are assumed to be competent for diagnostic purposes, the evidence is therefore quite conclusive that malignant and non-malignant tumors in South Africa among the native population are relatively still rather rare.

I will not further enlarge upon the contents of the African reports although there is much more material that could have been included, but I may add that for the Colony of Gambia, for example, I have examined five years of reports of the local health service revealing extremely few cases of malignant tumors admitted to the local hospitals under European administration.

I cannot, however, omit from the foregoing discussion a reference to an extremely interesting contribution on "Cancer and Race in British Guiana" by Dr. J. F. C. Haslam of the Government Public Health Department, British Guiana. He points out by way of introduction that the population of British Guiana consists in round numbers of 120,000 Blacks of African origin and 120,000 East Indians together with a comparatively insignificant number of other nationalities. The Blacks and East Indians have lived side by side for many years under identical climatic conditions and the other circumstances of their existence present no wide divergencies between the two races. As to occupation, the East Indians are more exclusively agriculturalists than the Blacks, while the latter do most of such heavy labor as is done at all. As to diet, some of the East Indians do not eat meat, and a large number are restricted, as to the kind of meat eaten, by religious considerations; the Black eats anything which his purse can compass. The strictly vegetarian high caste Brahmin hardly exists in British Guiana and the tendency is for racial and religious prejudices as to diet to disappear. Rice figures prominently in the dietary of both races under consideration. No statistics of value for the present purpose are available for the years previous to 1891. Prior to 1910 the site of cancers was not stated and prior to 1920 it was only for the East Indians that deaths were placed in age groups. Hence the most useful statistics are for the years subsequent to 1920. The age and sex composition of the different races cannot be accurately arrived at but it is certain that in some years at least the two populations differed markedly in these re-

spects. Subject to the foregoing limitations and deficiencies, examination of records for thirty-three years shows that during this period, 1754 persons died of cancer, of whom 397 were East Indians and 1357 were others. This term includes the whole population of the Colony less East Indians, but the white population is very small. On this basis the cancer death rate for 1921–24 is estimated at 9 per 100,000 for East Indians and 17 for the Blacks and other mixed blood population. From year to year the rise and fall in the rate in the two races have corresponded remarkably. In other words, the East Indian rate has been consistently lower than the Black and other white and mixed blood population. Dr. Haslam raised the question whether it is possible to apply the foregoing information so that one may judge of the cancer mortality among Blacks. The Blacks, he points out, form the largest and a very constant constituent of the "Others" population, varying from 66 to 68 per cent of the total. Any racial features of the Blacks as to cancer mortality would therefore strongly and constantly influence the mortality rate for "Others." On the basis of such information as he was able to collect, he calculated the Black population for 1924 as 119,470, and the total of other populations as 176,237. Among these elements during 1924 there occurred only 52 deaths from cancer, equivalent to a rate of 29 per 100,000. He argues that supposing the rate for Blacks was the same as for the East Indians, then for the thirty-four years under review, the remainder of Europeans, Chinese, Portuguese and mixed, would require to have had a cancer mortality of 25 per 100,000, or nearly double that for the whole population. But even if the whole population's rate is applied to the Blacks, then the rate for the Europeans, etc., must still have been as high as 25 per 100,000, which is by no means incredible even granting that all the white populations are assigned a lower cancer death rate in temperate latitudes. Dr. Haslam, however, calculates, for the last five years under review, the specific death rate for Blacks and East Indians with the following

results. Whole population, 19 per 100,000; black population, 22 per 100,000; East Indians, 11 per 100,000. He gives the distribution by sites for the black population as follows; buccal cavity, 6; stomach and liver, 54; peritoneum, intestines and rectum, 1; female generative organs, 38; breast, 24; skin, 2; other organs or parts, 37, a total of 162. He also gives some statistics by ages for the black population as follows: deaths from cancer under twenty, only 2; ages twenty to thirty, 4; thirty to forty, 20; forty to fifty, 27; fifty to sixty, 46; sixty to seventy, 32; seventy to eighty, 19; over eighty, 12. These were not suggestive of anything very abnormal in the age distribution, except as is the case in all tropical countries, the proportion of persons over sixty is less than for the corresponding white population in temperate latitudes. Dr. Haslam calls attention to the much higher proportion of cancer of the breast among the Blacks than among the East Indians. He concludes his interesting observations with the following statement:

> In view of the imperfections in statistical records it is impossible to consider the results of this enquiry as conclusive, but there appears to be a prima facie case for the opinion that there is a racial difference as to cancer mortality between the East Indians and Blacks in British Guiana. It may be possible to check the results obtained against the statistics of other places and the enquiry is being pursued.

I may seem to have drifted far afield in my discussion of the cancer mortality of the American Negro but I feel strongly that the question at issue cannot be fully understood without an international background in view of the alien origins of our negro population. Those who wish to pursue this study further cannot do better than read an interesting discussion entitled, "The Cradle of the World and Cancer, a Disease of Civilization," by Dr. Ernest H. Tipper of the West African Medical Service (retired), published in London in 1927. It has some extremely valuable observations on the negro in Africa and the extreme rarity of cancer in natives not in contact with civilization but pointing out evidence that the liability to the disease

increases almost invariably with the growth of town settlement and contact with the white population. Dr. Tipper is emphatically a believer in the dangers of a high protein or meat diet and he produces much evidence in support of his view that abstinence or moderation in meat eating often coincides with the rarity of malignant tumors. He gives a most interesting account of native foodstuffs which suggests the urgency of similar dietary studies of the negro population in this country. The only two really qualified dietary studies of negroes with which I am familiar have been made in this country and published in 1897 and 1899, respectively, on the negro population of Central Alabama and the negro population of Eastern Virginia. These two studies are suggestive of dietary variations particularly in the case of plantation negroes well deserving of serious consideration. I cannot enlarge upon this phase of the problem without unduly extending the scope of my remarks.

I would fail also if I did not point out in this connection that the whole discussion of the American negro cancer mortality is vitiated by the omission of the elements of race intermixture as the result of which we deal with a heterogeneous population of which only a relatively small proportion represents a strictly African type. For several hundred years the negroes of this country have been in contact with our civilization and are habituated more or less to our mode of living. The range of intermixture runs from almost near white to pure black including every possible alien strain of blood, producing an entirely new type of mankind immensely at variance with the negro population of Africa or for that matter for some parts of the West Indies. It should not be difficult, however, to carry on an extended research into the subject and single out survivals of the earlier African origin of our negro population, and ascertain the varying degree of susceptibility in the pure black, the near black, brown, yellow and near white types of the race. Without such discrimination all observations upon the cancer mortality of the negro population, considered as a homogeneous group, must be more or less fallacious and

approximate closely the corresponding results for the white population. Even so, however, there are still marked differences which become more and more apparent as we deal exclusively with the negroes in the black belt and particularly in such sections as the Sea Islands of South Carolina. I am strongly inclined to think that malignant tumors in the pure blacks will be found to be much less common than in those types which show a considerable degree of white intermixture. But this question for the time being cannot be answered.

Briefly summarizing the foregoing the following conclusions would seem to be justified by the evidence available.

1. The present cancer mortality of our American Negro population tends more and more to approach the corresponding cancer death rate of the white population.

2. The cancer death rate of the negro population has shown a persistent rise during the last thirty years and is now in marked contrast to the earlier death rates although more or less imperfectly recorded.

3. Fragmentary evidence available seems to justify the conclusion that malignant tumors in the slave population were extremely rare, corresponding in this respect to present day conditions in practically all parts of Africa.

4. The outstanding fact of the negro cancer mortality is the much greater liability of negro women to tumors of the generative organs, and in addition thereto a very much greater liability to non-malignant tumors of the same organs.

5. Among the most useful data on the differential mortality of the two races are found in the experience of the Metropolitan Life Insurance Company for the period 1911–1922. By organs and parts these show the following illustrative differences: Cancer of the buccal cavity for males shows a death rate of 4.5 for the whites and 2.3 for the negroes. This difference is sustained by a wealth of other data indicating the decidedly lower liability to cancer of the buccal cavity on the part of the male colored population. Cancer of the stomach and liver, however, for males shows a death rate of 23.9 for the whites and

17.4 for the negroes. For females the respective rates were 28 for the whites and 19 for the negroes, suggestive of the lesser liability on the part of the negro race for both sexes. This difference unquestionably is partly at least attributable to variations in dietary habits which are deserving of extended study. Cancer of the female generative organs shows a death rate of 24.9 for white women and 38.4 for colored women. The much greater liability of negro women to cancer of the uterus, ovaries, etc., is sustained by a wealth of other data for both this country, the West Indies and Africa. Cancer of the male breast shows a rate of 0.1 for the whites and 0.2 for the negroes. This conclusion is also supported by other data suggestive of certainly double the liability of negro males to cancer of the breast, which however is an extremely rare affection. Cancer of the female breast shows a rate of 11.7 for the whites and 14.6 for the negroes. This higher liability to cancer of the breast is rather in contrast to general conceptions as to the relation of cancer of the breast to habits of breast feeding. As far as I know, negro women much more generally nurse their babies, even to their second year, while the practice of bottle feeding is apparently much more common among white women. Other causative factors, therefore, must enter into the greater liability of negro women to cancer of the breast than breast-feeding habits. Negro women also wear much less obstructive clothing than white women and yet they suffer more from cancer of the breast, which is very often attributed to the wearing of corsets or tight lacing.

6. Cancer of the skin prevailed at the rate of 2.1 for the white males and 0.7 for colored males. For females the rate was 1.6 for the whites and 0.8 for the negroes. This conclusion is also supported by much other evidence suggestive of the protective value of skin pigmentation. Of special importance on this phase of the problem are the observations on Melanosis by Dr. W. G. Spencer in his Bradshaw Lecture in 1923,[1] illustrating the importance of pigmentation in the etiology of new

[1] Reviewed in the *Brit. M. J.*

growths. All the authorities that I have consulted on the subject seem to hold to the opinion that the colored races are less liable to skin cancers on this account and certainly this view seems to be supported by the available statistics. Paul, in his treatise on "The Influence of Sunlight in the Production of Cancer of the Skin"[1] observes that:

> The pigment of the skin stands as a sentinel, guarding the underlying tissues from the baneful effects of sunlight. In the white races this pigment is confined for the most part to the periphery of the cells of the basal layer of the epidermis and to the lowermost stratum of the prickel-cell layer, whilst the pigment granules may also be found in the interepithelial lymphatic spaces, and in the fusiform connective tissue cells of the papillary body. In the dark races, Macleod states that pigment is to be found as high up as the transitional layers of the epidermis, as well as in some of the connective tissue cells of the superficial portions of the corium. But the white races have the power of reacting to the external stimulus of light with an increase in the amount of pigmentation. The common occurrence of these cancerous and precancerous diseases of the skin in Australia is to be regarded as normally destined to be occupied by a coloured race.

The subject of the occurrence of skin cancers in Australia has been exhaustively studied by Dr. Herman Lawrence who has made a number of valuable contributions to this phase of the problem but it would carry me too far to enlarge upon it. In any event cancer of the skin constituted only 1.4 per cent of the negro deaths from cancer in the United States during 1923–27. In the total American population in 1927, this proportion was 2.8 per cent. Thus there is a marked difference, in favor of the negro, in cancer of the skin, deserving of consideration.

7. As regards diagnosis, it goes without saying that in many cases the whites in this respect have a great advantage on account of earlier and better treatment. But this conclusion hardly applies to the major portion of the colored population living in our large cities. The negro shows no aversion to making use of hospital facilities and in some instances is probably more ready to go to institutions than a white person. The statistics in this respect for New Orleans are quite convincing.

[1] Lond., 1918.

In the matter of autopsies, however, there is a lesser chance of a correct final diagnosis in the case of the negro which probably somewhat impairs the value of the general statistics.

With these observations I conclude an inquiry into a most important phase of the general cancer question. I cannot too strongly emphasize my convictions that a thorough study of cancer in the American Negro and collateral studies of cancer in the negroes of the West Indies and Africa would lead to very important conclusions. It is to the credit of Dr. Matas that he should have been among the first to emphasize the racial differences, and I consider it a great privilege to be permitted to contribute to this interesting symposium of his outstanding work as a physician, surgeon and benefactor of mankind.

# CANCER OF THE STOMACH

## WITH SPECIAL REFERENCE TO ITS INCIDENCE, DIAGNOSIS AND TREATMENT

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### INCIDENCE

THE last census reports available for the estimation of the mortality from cancer in the United States show that in the year 1927 there were 103,578 deaths from cancer in the Registration Area of the United States. Of these, 36,879 were from cancer of the stomach and liver. As primary cancer of the liver is very rare, and as deaths are listed according to the original site of the cancer, it seems probable that at least 35,000 are from cancer that originated in the stomach.

In Virginia there were during 1929, 1686 deaths from cancer as against 1567 in 1927, with 560 deaths from cancer of the liver and stomach in 1929 and 516 in 1927, probably more than 90 per cent of this combination being from cancer of the stomach.[1]

Deaths when sudden and spectacular attract much attention, as from the explosion of an airship, a railway collision, an automobile accident or the sinking of a ship. But the fact that more than 100,000 persons perish quietly in the United States every year from cancer (one-third of them from cancer of the stomach) causes but little comment. Cancer of the stomach is responsible for far more deaths than cancer of any other single organ. When we consider that malignant tumors from all other regions, such as the colon, rectum, pancreas, kidneys, bladder, prostate, breast, ovaries, uterus, mouth, neck, brain, skin, muscle and bone make up the balance which is scarcely two-thirds of the total mortality from cancer, we can readily see how seriously cancer of the stomach should be considered.

### CAUSES OF DEATH FROM GASTRIC CANCER

In a recent article by Saltzstein and Sandweiss[2] of Detroit, there is an analysis of 365 consecutive deaths from cancer of the stomach collected from the Cancer Division of the Department of Health of Detroit. It includes all the deaths registered as due to cancer of the stomach from a population of 1,730,000 during one and a half years. Of this number, only 28, or 7.7 per cent, had resections of the stomach for cancer, and of these only 11, or about 3 per cent, recovered from the operation. It is obvious that many of this small group operated upon came late and were desperate risks.

Margaret Warwick,[3] in a report of 176 necropsies on cancer of the stomach from the Department of Pathology of the University of Minnesota, extending over a period of twenty years, shows that the deaths from cancer of the stomach occupy a total of about 30 per cent of all the Department's necropsies on cancer. Her report brings out many interesting facts. The age varied from thirty-two to eighty-two years, but the average age was fifty-nine years. The largest number of deaths in any decade (35 per cent) occurred in the sixth decade, and the next largest number (29 per cent) in the fifth decade. Cancer of the stomach was found much more frequently in men than in women, and was often located in the pylorus (42.2 per cent). It is interesting to know, too, that in only 43.4 per cent of the cases of this series was ulceration present, and of this number 51 per cent showed perforation and in about one-third of these the perforation was plugged. In two-thirds of the cases with perforation death from peritonitis occurred. The most frequent fatal complication was peritonitis. There was no emaciation in about 18 per cent of the cases. In 23 per cent, or 40 of the fatal cases, there was no metastasis, the growth at the time of death being confined entirely to the stomach. In many of these cases the death was due to peritonitis.

*This brings up the subject from a new angle. The fact that of this series of* 176 *deaths from gastric cancer* 23 *per cent* (40)

*of the cases had no metastasis, the growth being confined to the stomach at the time of death, and yet in the larger series of Saltzstein and Sandweiss (365 cases) resection was done on only 7.7 per cent (28 cases), shows that many opportunities for cure must have been missed. In some of the 23 per cent the cancer was probably located in the inaccessible cardiac regions, but it is more common at the accessible pylorus than elsewhere.*

Cancer of the stomach presents variable forms. We are often accustomed to think of it as an ulcerating necrotic mass and yet the statistics of Warwick show that in only 43.4 per cent of these necropsies was ulceration present.

## ETIOLOGY

The cause of cancer is a subject which the limit of space will not permit us to discuss except to say that the theory that seems more probable now than any other is that cancer is not due to a parasite or any microorganism, but that it springs from a derangement of one or more local cells in the tissues. This derangement results in a freeing of the cells from the normal control of the surrounding tissues, which abolishes the restraint of going through the normal biologic processes of growth. These cells after acquiring this attribute of unrestrained growth can transmit it to their own offspring. The fact that cancer in mice can be produced in the laboratory by frequent painting of the mice with tar, and that the resulting cancer will metastasize and can be transplanted, shows that some irritant is primarily responsible for the neoplasm. It may be, of course, that some microorganisms act indirectly by causing irritation, but that cancer is primarily due to bacteria or a microscopic parasite in the same sense that typhoid or tuberculosis is, is hardly tenable.

Certain tissues of the body are less liable to cancer than others. The cause of this comparative immunity is not known, but very obviously exists. It may be due to the natural stability of the tissue. I have never seen a primary cancer of the palms of the hands or the soles of the feet, yet cancer of the mouth,

tongue and lips is common. Cancer of the stomach is also common, and as has been stated, is one of the greatest causes of mortality from cancer, and yet cancer of the duodenum is extremely rare, almost a surgical curiosity. It is necessary, then, to have some cause besides irritation.

So far as we know, from observable regions of the body, cancer never springs directly from normal tissue. If this holds in the face, tongue, rectum or uterus that can be observed, it seems highly probable that the same general rule should obtain in the stomach which is difficult of direct inspection. It would be an anomaly if the irritation in the stomach caused by peptic ulcer did not occasionally at least produce cancer, whereas irritations of the mouth and lip of people of the same age are known to be one of the chief causes of cancer. Ulcer of the stomach is much less frequent than ulcer of the duodenum, in the ratio of probably about 1 to 4, but the duodenum, like the palms of the hands, seems almost immune to cancer. In fact, the number of cases of peptic ulcer of the stomach corresponds in a general way to the number of cases of cancer of the stomach. Much stress has been laid upon the size of the ulcer of the stomach, the large ulcers being more likely to be cancerous than the smaller ones. My own experience, however, shows that while this in a general way is true, there are many exceptions to it. I have had several cases of large ulcers of the stomach 5 or more centimeters in diameter that were benign, and one case at least of a small ulcer of the stomach, not more than 1.5 cm. in diameter, that proved to be malignant. No set rule can be made for this, but the marked tendency is for the larger gastric ulcers to be cancerous.

### SYMPTOMS

The symptoms of cancer of the stomach are not typical. The most important thing to bear in mind is that there is no typical history or symptom of cancer of the stomach. It is more frequent in men. In Saltzstein and Sandweiss' analysis of 365 cases it was found that about one-fourth of all the

cases gave a history of prolonged attacks of stomach trouble, and about one-third of this number gave a fairly typical clinical history of peptic ulcer. It must be recalled, however, that gastric peptic ulcer is not infrequently found without a so-called typical history. The large gastric ulcers may cause more or less discomfort with no connection with food relief, and sometimes the first symptom is hemorrhage. Hemorrhage is a rather infrequent symptom in cancer of the stomach, probably less than 2 per cent (1.4 per cent in Saltzstein and Sandweiss' cases). When it is considered that, according to Warwick, only 43 per cent of cancers of the stomach showed ulceration, we can see that hemorrhage is by no means as common in cancer of the stomach as is usually supposed.

The examination of the gastric contents in cancer of the stomach usually shows a low hydrochloric acid content or, not infrequently, a complete absence of hydrochloric acid. This, however, is by no means a universal finding, as early gastric cancer may occur with normal hydrochloric acid in the gastric juice. Blood and lactic acid in the gastric juice may be suggestive, but should not be depended upon too much.

In about three-fourths of the cases there are no preliminary symptoms, but the cancer arises in otherwise apparently healthy individuals and goes on steadily toward death. There are, however, many cases of antecedent long-drawn-out histories of stomach trouble extending over periods of years. In one of my patients whom I operated upon at the age of seventy years, there had been intermittent stomach trouble with some food relief for forty years, and at operation there was cancer of the pylorus, not very advanced, but producing partial obstruction.

In the three-fourths of the cases of gastric cancer in which there are no such preliminary symptoms, the situation is more serious because by the time symptoms from the cancer have arisen the growth may be well advanced. In many of these instances the cancer is in the so-called silent areas of the stom-

ach. Physiologists have shown that the lesser curvature contains tissue acting somewhat like the neuromuscular tissue of the heart, and initiating peristalsis; an ulcer or lesion in this region usually produces symptoms because of the spasm and interference with the motor function of the stomach. Of course, at the pylorus obstruction occurs early. In many cancers of the stomach (about 42 per cent according to Warwick) the tumor is at the pylorus and will cause early symptoms of obstruction. Because three-fourths of gastric cancers arise in apparently healthy persons without preliminary symptoms and march on to inevitable death unless the cancer is removed, it does not mean that there was not a preliminary lesion. As has been mentioned before, cancer elsewhere in the body always starts from abnormal tissue, and it is reasonable to expect this to be true in the stomach. Necropsies and roentgenologic examinations not infrequently show ulcers of the stomach or healed ulcers that have given no symptoms. Lesions along the greater curvature or in the cardiac portion of the stomach may exist without causing any symptoms unless perforation or hemorrhage occurs, or unless the growth is so large as to produce obstruction. In a case of my own (Mrs. S.), a cancer of the colon was removed which had given symptoms only for a few months, though the growth must have been present much longer, and there were several benign adenomas in the region of the cancer. It seems highly probable, then, that some lesion such as a symptomless adenoma or ulcer has been the preceding cause of the cancer of the stomach that arises without preliminary symptoms. It is well known that in the colon and rectum benign adenomas and papillomas that have existed for years often degenerate into cancer.

Miller, Eliason and Wright[4] have recently reported eight cases of their own in which carcinomatous degeneration of a polyp of the stomach occurred. They think this condition is much more frequent than is usually believed, and have found it in 35 per cent of all gastric polyps they have fully studied. These polyps were adenomas or papillary adenomas, and were

usually found in men. The chief symptoms were hemorrhage and intermittent obstruction. In some of their cases the hemorrhage was slight but frequent, and caused profound anemia resembling pernicious anemia.

According to Saltzstein and Sandweiss, of 213 patients who died of cancer of the stomach when the onset was from previous good health, in 74 the first symptom was "indigestion," pain in the epigastrium in 21, a history of ulcer in 20, vomiting in 15, gastric hemorrhage in 3, difficulty in swallowing in 5, gnawing sensation in the epigastrium in 3, distended abdomen in 3, and fullness in the stomach in 3. Of the atypical symptoms there was loss of weight and weakness in 37, loss of appetite in 14, atypical pain (not in upper part of abdomen) in 11, anemia in 2 and diarrhea in 2. It is readily seen, then, that there is no typical symptom for cancer of the stomach, either when it results from the changing of a gastric ulcer into cancer or when it arises in individuals who are otherwise apparently healthy. It is significant to note, however, that in a long history of stomach complaint when the symptoms change and become constant instead of intermittent, or when the appetite begins to disappear and the patient loses weight, or when vomiting of blood occurs, there often seems to be a transition from a benign condition into malignancy. I am trying to avoid the use of emaciation, palpable tumor, vomiting blood and cachexia as symptoms of gastric cancer, because these are often the terminal stages and too frequently the patient with these symptoms may have gone beyond hope. Even in such patients, however, there may occasionally be some chance for cure or at least palliation by operation. If we recall the fact that, according to Warwick, in 40, or 23 per cent of, necropsies for cancer of the stomach the cancer was limited to the stomach itself, it appears possible to have a palpable tumor, hemorrhage and some cachexia while the cancer is still confined to the stomach. This, of course, does not mean that we should wait for terminal symptoms, but it does mean that there are some apparently advanced cases

that may occasionally be saved. Palpable lymph nodes in the lower portion of the neck, especially on the left side, referred to as Virchow's glands, in the presence of cancer of the stomach indicate that there are metastases through the chest and in the supraclavicular region. Such cases, of course, are obviously inoperable from any standpoint of cure, and this may be one of the terminal symptoms. When the cancer of the stomach is of very great malignancy, metastases may occur in the lymph nodes of the neck before the lesion in the stomach has progressed very far.

The most dependable means of diagnosis of cancer of the stomach is a roentgenologic examination by a competent roentgenologist. Nothing requires more care and responsibility than the examination of the stomach by *x*-ray. While pictures of fractures can be easily taken, a competent roentgenologic examination of the gastrointestinal tract requires great skill. I have not infrequently had *x*-ray plates referred to me with a diagnosis of cancer of the stomach when the defect was due to the pressure of the spine upon the plates while the patient was lying prone. One who does much gastric surgery will be able to recognize this type of *x*-ray plates rather easily and save the patient an unnecessary operation. Fluoroscopic examination is as important as the plates, and should be interpreted by a competent roentgenologist. In the hands of a well-trained roentgenologist, a diagnosis of cancer of the stomach can be made rather positively in about 90 per cent of the cases; on account of the location of the lesion and for other reasons in about 10 per cent the diagnosis cannot be made even by the best roentgenologist.

The chief thing that I wish to impress is that if a patient, particularly a man, begins having symptoms of so-called indigestion or stomach trouble, after thirty-five years of age, and it cannot be cleared up by ordinary simple remedies and regulation of diet in two or three weeks, the patient should be referred to a competent roentgenologist for a thorough examination of the gastrointestinal tract. If an ulcer of the

duodenum is found and is in an early stage, it should be treated medically for at least several months, or even longer if there is no complication. Many peptic ulcers of the duodenum can be cured by careful medical treatment. It is only when they resist medical treatment and recur, or when there is perforation, hemorrhage or obstruction, that operation is indicated. In the persistent types, however, or when the ulcer is very large, operation is the best treatment.

In an ulcer of the stomach the problem is different. Ulcers of the stomach are more difficult to cure by medical treatment and, in addition to that, the tendency for ulcers of the stomach to degenerate into cancer, which occurs to almost no extent in ulcers of the duodenum, is a very serious factor. If the ulcer of the stomach has been giving symptoms for only a few weeks, and can be treated satisfactorily and appears to be healing after six to eight weeks, the medical treatment may be continued longer, but if it is not healing it should be operated upon. W. J. M. Scott[5] has called attention to the fact that even *x*-ray examinations at intervals of a few weeks do not always show the actual facts, because sometimes the infiltration of a small lesion may fill out a niche, when as a matter of fact the cancer is still progressing. He has reported cases with gastric symptoms five to ten years and negative *x*-ray findings for cancer, and yet with cancer shown at operation.

## TREATMENT

There is only one treatment for cancer of the stomach, and that is excision. The sooner it is done the better. With modern technique and careful preparation, and with the choice of anesthetics, frequently either spinal or local, the mortality can be greatly diminished. The employment of the continuous intravenous injection of dextrose in Ringer's solution is very helpful, both as a temporary measure during the operation to prevent shock and following the operation to rest the stomach.

Gastroenterostomy in gastric cancer is rarely justified. A carefully done partial gastrectomy will carry almost as low

a mortality. If the cancer is so extensive that it cannot be resected, usually gastroenterostomy is contraindicated. There may be, however, occasional instances in which this operation is indicated. Saltzstein and Sandweiss state that: "It is being appreciated lately that gastric resection, if at all feasible, is a better palliative procedure than gastroenterostomy; patients are more comfortable following it, and patients with nodules in the liver have lived three years after gastrectomy for cancer."

For the past seven years I have been using a technique which is a modification of the Billroth 1 partial gastrectomy.[6] This consists in uniting the lesser curvature of the stomach to the upper border of the duodenum, flaring open the anterior wall of the duodenum to prevent obstruction, which was a great objection to the original Billroth 1, and folding in the redundant portion of the stomach along the greater curvature. In this way the so-called "deadly triangle" of Billroth is avoided. Occasionally, if the stomach is small, the duodenum may be flared open enough to make an end-to-end anastomosis.

When the cancer is too extensive for partial gastrectomy, a total gastrectomy may sometimes be done. In the case of Mrs. L. J., this operation was performed and the jejunum was united to the esophagus. Unfortunately in lifting up the stomach much of its contents regurgitated into the esophagus and when the clamp was removed from the esophagus after detaching the stomach the upper portion of the abdominal cavity was contaminated by the reflux from the esophagus. Though the peritoneum had been packed off with gauze, infection resulted and the patient died five days after operation. Examination of the stomach showed the cancer almost throughout the stomach, though necropsy did not reveal evidences of malignancy elsewhere.

In one patient, Mrs. B. H. H., a palpable tumor in the upper abdomen had been noticed by her for more than a year before she would submit to operation. A partial gastrectomy done according to the technique described resulted in immediate recovery. The patient lived in comfort for nearly three

years, and died of metastases in the chest and axilla with apparently no recurrence in the stomach. This shows that cases with palpable tumors are not necessarily inoperable.

In 1928 I published an article[7] on gastric cancer in the aged, reporting 5 patients over seventy years of age on whom this partial gastrectomy was done. In 2 of them part of the colon had to be resected. The operative mortality was one, the patient dying as a result of resection of the colon. The oldest patient was seventy-seven years of age, and died nine months after operation of nephritis. No necropsy was held, but there was no evidence of recurrence of the cancer. The other patients lived comfortably from six months to two years, developing metastases usually in the liver. In spite of the fact that all of these cases were far advanced, two of them necessitating resection of the colon, and all of the patients over seventy years of age, the results in prolonging life and establishing comfort may be considered as not unsatisfactory.

I have had one patient, Mrs. L. E. H., seventy years of age, who had had symptoms for fifteen years. The symptoms were increased before entering the hospital. A partial gastrectomy was done and a rather small ulcer was found along the lesser curvature of the stomach. It seemed to have been irritated and caused marked spasm. On microscopic examination of the lesion one area was found in which there were two definite acini of cancer. This patient has been in excellent health since operation nearly two years ago (December 10, 1928) and will probably make a permanent cure. It is in patients such as this in whom the malignant lesion is found in the early stages that the best results are obtained.

## SUMMARY AND CONCLUSION

Saltzstein and Sandweiss have shown that in Detroit, with its abundant hospitals, only 7.7 per cent of patients with gastric cancer have a partial gastrectomy. It seems probable that the percentage is even lower in Virginia. As partial gastrectomy is the only known cure for cancer of the stomach,

this means that only about one patient in twelve with cancer of the stomach is given any chance for a cure. Partial gastrectomy in early gastric cancer should give cures comparable to those after the radical operation for cancer of the breast, and even in the more advanced cases it often brings relief and prolongation of life. While it is necessary to study the early stages of any unusual gastric disorder in patients, particularly men, over thirty-five years of age, it is also well to remember that about one-fourth of the cases of gastric cancer are subsequent to some other gastric lesion giving symptoms for a long time (usually ulcer), and practically all of these cases should be recognized and operated upon in the early stages. In the other 75 per cent of cases, prompt attention to the first symptoms and a partial gastrectomy as soon as the diagnosis of gastric cancer is made will often result in the prolongation of life and sometimes in cure, whereas otherwise there is no hope.

## REFERENCES

1. Virginia Bureau of Vital Statistics, Annual Report. *Virginia Health Bull.*, 22: (Jan.) 1930.
2. Saltzstein, H. C., and Sandweiss, D. J. The problem of cancer of the stomach. *Arch. Surg.*, 21: 113–127 (July) 1930.
3. Warwick, M. Analysis of 176 cases of carcinoma of the stomach submitted to autopsy. *Ann. Surg.*, 88: 216–226 (August) 1928.
4. Miller, T. G., Eliason, E. L., and Wright, V. W. M. Carcinomatous degeneration of polyp of the stomach: report of eight personal cases with a review of twenty-four recorded by others. *Arch. Int. Med.*, 46: 841–878 (Nov.) 1930.
5. Scott, W. J. M. The relationship of carcinoma and callous gastric ulcer. *Surg. Gynec. Obst.*, 46: 199–212 (Feb.) 1928.
6. Horsley, J. Shelton. Operative Surgery. Ed. 3, St. Louis, Mosby, 1928.
   Partial gastrectomy. *Surg., Gynec. Obst.*, 44: 214–220 (Feb.) 1927.
7. Horsley, J. S. Cancer of the stomach in patients over seventy years of age. *Ann. Surg.*, 88: 554–564 (Sept.) 1928.

# CANCER OF THE BREAST

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PHILADELPHIA

IN THE hall of the University of Pennsylvania Medical School there hangs a celebrated painting, entitled: A Clinic of Dr. D. Hayes Agnew. Professor Agnew is depicted, after having removed a breast from a woman, as standing to one side and commenting, one can imagine, on diseases of the breast in general, and malignant diseases in particular, naturally also on the type of operation he has just performed, its advantages and general prognosis. This painting bears the date 1889.

I am proud to say that it was my great privilege to sit at Agnew's feet in my student days and to pass several years as one of his assistants in the Surgical Service of the University of Pennsylvania Medical School and Hospital. Agnew was a man of international fame as a skilful surgeon and a tremendous force in molding the practice of surgery in all parts of the United States from which his students came and to which they returned imbued with his teaching, fired with ambition by his brilliant surgery, and inspired by his charming and lovable personality.

The operation for carcinoma of the breast as performed by Agnew (at the time the portrait was painted) consisted of simple breast amputation and routine dissection of the axilla, whether or not the axillary glands were enlarged. This enucleation he did with the fingers after extending the incision from the lower angle of the wound into the axilla. In amputating the breast Agnew was careful to include all of the skin covering that showed the slightest suspicion of disease, without regard to the size of the wound. When conditions permitted, his routine procedure consisted of two elliptical incisions, an upper and a lower one, parallel with the course of the fibers

of the pectoralis major muscle. Beginning with the lower incision, the skin was dissected downward far enough to allow sufficient adipose tissue to remain to cover the gland; the upper incision was then made in a similar manner. Where the cellulo-adipose tissue was abundant, he used the finger partially to separate the tumor from the overlying tissues. The mamma was then torn from the pectoral muscle by making strong traction on the breast, any adhesions that were encountered being separated with the knife. If the tumor had become adherent to the pectoralis muscle, Agnew tore it away by forcibly pulling on the breast rather than cutting with the knife, as by the former plan the diseased structures were more likely to be removed. When infiltration had extended to the base of the gland, even though there were no adhesions to the pectoral fascia, he dissected the latter carefully away from the muscle along with the breast. The vessels as they appeared were grasped with hemostatic forceps, but were not tied until after the breast had been removed. It is not necessary to describe his manner of closing the wound, although it is interesting to note that he made free use of antiseptic solutions at that time, with the remark that "only two weeks will be required for the healing of the wound uncomplicated by surgical fever or pus, a striking contrast to the results of the old manner of treatment, in which ordinarily from four to six weeks were spent in almost daily renewal of dressings and the pressing out of purulent matter."

This operation, considered quite a radical procedure at that time, was based on the practices of Charles Moore of Edinburgh who suggested it as early as 1867, in a paper entitled: "The Influence of Inadequate Operations upon the Theory of Cancer." Moore, in fact, recommended also the removal of the pectoralis major muscle and the lymphatic glands. In the evolution of surgery of the breast, the younger Gross (S. W.) of Philadelphia was among the first American surgeons to recognize the wisdom of this procedure and to advocate its adoption in practice as a possible means of curing

cancer of the breast, if, as he puts it, "it is attacked before it has disseminated itself extensively locally or has tainted the general system." Gross emphasized the primarily local character of mammary cancer, its tendency to advance toward the surface before it invades the deeper structures, the lymphatics and the viscera, and with refreshing confidence stated that local infection does not ensue, on an average, before the expiration of thirteen months, skin involvement in fourteen months, lymphatic glands in fifteen months, the walls of the chest in twenty-two months and the viscera in thirty-one months. Gross, being satisfied with three years after the last operation without recurrence as constituting a cure, claimed 10.5 per cent of cures, that is 51 out of 485 cases of ordinary scirrhous, medullary, colloid, or atrophying carcinoma, the average postoperative period being four years and ten months. We today are not quite so definite as to the time of involvement of the various parts, nor are we satisfied with a three year period of freedom of recurrence as constituting a cure, as will be seen later on.

The evolution of the modern radical operation for cancer of the breast has kept pace with the evolution and clearer understanding of the process of local dissemination of cancer cells. Moore was probably the first to enunciate the principles of metastasis and their practical application to the surgical treatment of carcinoma of the breast. He pointed out that after operation the disease spreads in the skin, the paramammary fat, the remaining portions of the mamma and the axillary glands. Accordingly, he advocated removing the entire breast and its covering, searching for outlying nodules that may be disseminated throughout the mammary region, dissecting off the fascia of the pectoralis major muscle and thorough exploration of the axilla.

It took some time for Moore's suggestion to make an impression upon the surgical world. Lord Lister in the early sixties is said to have pointed out the possibility and advisability of removing the axillary fat and its contained glands, and

in most cases also stripping off of the pectoral fascia. In America Gross, as we have seen, was the first to fall in line with Moore's views, and as late as 1880 felt obliged to defend his "boldness" in recommending that the axilla be attacked even when it seemed apparently free from disease. The prevalent theory in Moore's day was that malignancy is a systemic process. This theory was so deep rooted in the minds of the surgeons of that day that one must admire Moore for his bold stand and honor Gross and other surgeons who fearlessly followed in his footsteps.

The quarter of a century that followed Moore's contribution to the question of the operative treatment of cancer of the breast was characterized by active research into the pathogenesis of tumors and of cancer dissemination. It soon became apparent that the process of dissemination is a very complicated one. Even today, although we know that embolic invasion of adjacent lymph nodes occurs regularly, the problem of the further progress of metastatic cells still awaits solution. Dissemination, no doubt, begins early in the disease. Even the earliest clinical cases, that is, those that are seen within a few weeks or a month or two after a tiny lump in the breast is first noted, often present axillary involvement, occasionally detected clinically, but more often first found in the microscopic examination. Of course, we have no way of knowing in these cases how long the disease may have been latent before it became manifest in the shape of a tiny lump. In spite of various theories as to the time in which metastasis develops, that is to say, a theory that is applicable to all cases, experience has taught us that the premetastatic interval varies in different individuals, and that it is not very unusual, for example, for visceral involvement to be present without any palpable lymph nodes in the axilla.

Unsatisfactory as is our knowledge of the time relation of the primary growth and metastatic spread, we are on somewhat firmer ground as to the avenue by which dissemination travels. This we owe to the brilliant investigations and studies

of William Sampson Handley, with the resulting theory of centrifugal lymphatic permeation. This theory is the most rational explanation we yet have for the regional dissemination of cancer, as well as for a large percentage of local postoperative recurrences. It also forms a rational basis for the radical operation for cancer of the breast as it is generally practiced today.

History, to some extent, repeats itself in that a theory formulated by an Englishman received its application at the hands of an American surgeon, William Halsted. It is true that the radical amputation of the breast to include excision of the pectoralis major muscles was first practiced by Volkmann (1875) but he did so only where the muscles were visibly affected by the disease and not as a routine measure based on a rational theory. In passing I may say that knowing as we do, that involvement of the pectoral muscles indicates an advanced stage of malignancy, Volkmann's results were very remarkable. He claimed that local recurrence took place in only 35 per cent of cases in which the muscles were removed and in 58 per cent there were either local or regional recurrences, while in early cases in which the muscles were allowed to remain, there were 60 per cent of recurrences. It would seem, therefore, in the light of our present knowledge, that his results were in large measure due to the greater ease of approach to involved fascial and lymphatic structures provided by the removal of the muscle *per se*.

As I have already said, while to Handley we are indebted for the basic theory for the radical operation, it is to Halsted we owe the practical application of this theory and the perfection of the operation. By a remarkable coincidence Willy Meyer, of New York, and Sir William Watson Cheyne, of Scotland, simultaneously devised a similar procedure quite independently of Halsted. Willy Meyer urged the removal of both pectoral muscles in order to insure a more complete axillary dissection.

Before this time the pathogenesis of regional recurrences was entirely misunderstood. Billroth, for example, applied

the term regional recurrence to a return of the disease as long as one and a half years subsequent to operation, thus creating the impression, now considered false, that the recurrent growth was a new process, dependent either upon cancer diathesis in general or a local predisposition in the scar, and as occurring absolutely independently of the original growth. The enormous percentage of local recurrences shown by statistics, principally from large German Clinics over a period of twenty-three years (1867–1890) before the practice of systematically cleaning out the axilla had come into use, convinced Halsted that much of the fault must be due to the incomplete removal of cancer-laden tissues. Many surgeons in America at this time were in despair because of the hopeless prognosis of the surgical treatment of breast cancer. In fact, Halsted quotes Agnew as having remarked, shortly before his death in 1892, "that he [Agnew] operates on breast cancer solely for the moral effect on the patient, that he believes the operation shortened rather than prolonged life." This rather pessimistic attitude was scarcely justified, however, in view not only of Agnew's results but of the general results compared with those of previous decades. Halsted, however, struck at the fundamental cause of this sad plight of both patient and surgeon. With regard to the procedure as practised by advanced surgeons of his day he pertinently asks: "Why should we shave the under surfaces of the cancer so narrowly of the pectoralis muscle when a part of it can be removed without danger and without subsequent disability, and if there are positive indications for its removal?" Therefore he advises that the "pectoralis major muscle entire, except its clavicular portion, should be excised in every case of cancer of the breast, because the operator is enabled thereby to remove in one piece all of the suspected tissues." This removal in one piece of the suspected tissues was intended to avoid inoculation which might result from division of these tissues, or by division of cancerous lymphatic vessels, and to make sure that no shreds or pieces of cancerous tissue are overlooked.

The principles of the block operation have now been extended to conform with the anatomy of other cancer involved organs. We now know that there exists a local predisposition to cancer, that while cancer cells easily transplant themselves in the area primarily involved, more remote autotransplantation is difficult, and cutting into a cancer nodule is as dangerous as opening an appendiceal abscess into the free peritoneal cavity. The prevalent operation today is based upon Halsted's original procedure with more or less effective technical changes. The most significant modification is that of beginning the dissection at the apex of the axilla rather than from below, as was done in the original operation. This is important mainly to avoid the traumatic dissemination of cancer cells along the lymphatic route, a study of the site of local recurrences having shown that they are more frequent in the vicinity of the lower angle of the scar when the dissection is begun above, and vice versa.

By this procedure, early advocated, among others, by Rodman of Philadelphia, the axilla is attacked before removing the breast and working toward the axilla avoids the danger of expressing cancer cells into adjacent or even remote tissues, and the breast is not handled or massaged until the axillary dissection is completed. This method also reduces hemorrhage since the vessels are ligated at their origin, the time of operation is shortened and shock is minimized. One feature of Halsted's operation which has been considerably modified is the removal of the supraclavicular glands as a routine procedure. This to most surgeons seemed too radical in cases where the glands were not palpably enlarged. Rodman, however, strongly advocated exploring the supraclavicular triangle in all cases where the tumor is a peripheral one located in the superolateral hemisphere, the most frequent site of breast tumors, basing his argument on the discovery by Poirier and Cunéo of a set of lymph vessels which drain in the upper half of the breast and passing over the clavicle empty into the supraclavicular lymph nodes.

My operative procedure likewise is based on Halsted's method, except that I practically never employ skin grafting and I remove both the sternal and the clavicular portions of the pectoralis major and the pectoralis minor muscles and with very few exceptions close the wound at once. In case of a large growth involving practically the entire breast and where, owing to the scarcity of fat in the superficial fascia, the surrounding skin is not freely movable, there may be some difficulty in closing the wound. This can be largely overcome by extensive dissection laterally and medially. It is my opinion that in the average operable case greater danger lurks in insufficient removal of the deep fascia than in the skin that is likely to be involved. Moreover, removing the deep fascia is in accord with Handley's theory of cancer dissemination and does not add to the gravity of the operation, while postoperative complications are less apt to occur than in cases where large areas of skin are removed. This method, however, is not applicable to all cases of cancer, nor in the presence of extensive ulceration, but with wide dissection of the skin, and with the flaps made extremely movable, the necessity of skin grafting rarely arises and necrosis of the flaps just as rarely occurs. When necessary I do not hesitate to leave the wound open and to allow it to heal by granulation. Usually the patients leave the hospital in two weeks, the average time being 16.8 days: 13.9 days in the uncomplicated, and 29.8 days in the complicated case. Primary operative deaths are exceedingly rare. Postoperative shock is sometimes delayed so that careful watching for some hours after operation is essential and in case of failure to respond to the usual diffusible stimulants, saline infusion is resorted to, but this also is rarely required. Consecutive hemorrhage may occur but is unusual in my experience. Where, however, there is evidence of active bleeding I do not hesitate at once to open the wound, in order to evacuate the clots, tie bleeding points and flush the wound with hot saline solution.

The immediate mortality is satisfactory, in fact, I dare say is beyond the dreams of even the most sanguine of the early

advocates of radical operation. How they would rejoice at a primary mortality of 2.0 per cent, the figures of the Lankenau Clinic for the last fifteen years (682 cases, 14 deaths). It thus can definitely be said that the radical operation for cancer of the breast is one of the safest major operations. Our satisfaction, however, is tempered by our inability to cure more of our patients, interpreting as cured those who are living and well ten or more years after operation. Most of the patients (45 per cent) die of recurrence or metastasis in one form or another from one month to three years after operation. Practically 50 per cent of all patients who survive the operation have edema of the arm with or without recurrence or metastasis. These facts and the following figures are gathered from a series of 189 individuals on the records of the Follow-up Service from its inauguration in October 1920 to January 1926, who have reported to the clinic in person or who have been traced through questionnaires or visits by the staff of the Follow-up Service. The actual number of breast cases treated during that period was 221, of whom 32 could not be traced.

Of the 189 patients 21 are living at the time of this study (January 1931). Of the 21, five (2.7 per cent) are living and in perfect health for ten years without ever having had the slightest sign of recurrence, edema of the arm or any other trouble; 12 are living and well without recurrence from five to eight years (more than five years, 5; more than six years, 2; more than seven years, 2; more than eight years, 3); the four remaining patients are living but have more or less extensive recurrences as follows: One developed a small mass in the axilla forty-two months after radical amputation. At her last visit, sixty-seven months after operation, the axillary nodule was reduced in size (under *x*-ray treatment). There was slight swelling of the arm but motion was good; one is living at 104 months after operation without local recurrence but has some enlargement of the liver; another is living at 113 months. The last-named went without signs of recurrence or edema for ninety-six months. She then developed a very tiny hard

nodule above the clavicle and edema of the arm. When last seen at 113 months the conditions were unchanged, but the patient appeared in excellent health and spirits; the fourth patient refused radical operation at her first admission. A tumor was removed from the left breast which biopsy proved to be malignant. The patient could not be persuaded to have the breast removed. She was free from recurrence for seven and one half years, having been under *x*-ray treatment from time to time. She is very uncooperative and it was difficult to get any definite information. She is living at 102 months, with the local condition unchanged, but reported that she was working daily as a general housemaid. A fifth case (one of the 13) likewise refused radical operation. The tumor, a papillary cyst adenoma, was removed. She did well for four years. At fifty months she developed a shotty tumor in the lower part of the scar which grossly was diagnosed fibro-adenoma. Again she refused operation and when last heard from, at 113 months, she was in excellent health and doing laundry work.

We thus can claim 8.9 per cent of five year cures and 2.7 per cent of ten year cures.

Among the many angles from which the subject of cancer of the breast is to be considered, the most important with regard to achieving better end-results, exclusive, of course, of the possible control of metastasis or recurrence, is the prevention of edema not due to carcinomatous invasion of the lymphatics. The latter, it appears to me, is a subject for investigation by our anatomists, especially the younger ones. A re-study of the lymphatics of the axillary region may perhaps yield some valuable discoveries concerning variations and anomalies in that region. Such a study may also reveal a method of anatomical grouping of individuals according to their particular arrangement of axillary lymphatics, so that it may become possible for the surgeon of the future to be in a position to decide what type of individual would have a tendency to develop edema, and thus perhaps be able to modify

the operation accordingly. This may sound chimerical but it is no more so than other ideas that have changed the entire aspect of medical and surgical thought.

I am fully aware that recurrence and metastatic extension of cancer are undergoing constant study, for therein consists a very important phase of cancer control. Early recognition and early treatment are the slogans of those concerned in this vital public health movement. Most of us are under the pleasant impression that the propaganda has been actually fruitful. A surprising result of the comprehensive study of this aspect of the subject made by Dr. Reimann, Director of the Lankenau Research Institute, is the fact that there is room for very great improvement in this respect. While on the whole patients are presenting themselves for treatment earlier, the change is insignificant. The average time of delay in all cases is still 5.6 months, and there has been no inflection in the curve to indicate that the educational campaign begun in 1914 has had any marked effect. In the three year period, 1923–27, we find that the patients came only about three and a half weeks earlier than they did in the period between 1900–1904, not enough to mark any material improvement. This means that the propaganda must continue unabated as one means of effective control of cancer. The evidence is discouraging, but it all the more emphasizes the necessity of continued unremitting perseverance in bringing the matter to the attention of the public. One often hears the remark made that publicity and propaganda are more harmful than otherwise, because of the alarm and terror they may arouse in an ignorant and unintelligent public. The argument is a specious one. The imaginary horror is not nearly so harmful as the actual terror that accompanies malignant disease.

Much is being said and written with regard to radiation in the treatment of cancer of the breast, both as a means of cure and as a preoperative or a postoperative adjunct to surgery. Much of the information on this subject, it seems to me, is obscured by the enthusiasm of its advocates and the

harsh criticism of its opponents. Personally, I may say that I am not enthusiastic one way or another. I have little opportunity of seeing any actual cures that have been obtained by radiation. While not by any means enthusiastic about post-operative radiation, I am prepared to say at present that herein lies its greatest field of usefulness. There is no doubt of its marked palliative effect in prolonging life and making it more bearable. In a number of instances it does dispel a threatening recurrence, but these are few and far between, at least in my experience.

# ANESTHESIA

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NO DEPARTMENT of surgery has shown greater development than that of anesthesia; on the other hand, in perhaps no other department of medicine has there been greater diversity of opinion regarding methods. In general, however, the trend has been the same, that is, away from the harmful, deep inhalation anesthesia toward lighter, less harmful anesthesia, analgesia, and regional and spinal anesthesia.

The history of anesthesia has been so well written by various authors: Gwathmey,[1] Flagg,[2] Allen,[3] and Braun,[4] that it is not necessary to recapitulate any phase of its historical record, except to emphasize the fact that to whomever belongs the credit for the first practical use of inhalation anesthesia, whether it be Long or Morton for ether, Wells for nitrous oxide, or Simpson for chloroform, the fact remains that with the fourth decade of the nineteenth century began a new era in surgery, paralleled only by the aseptic era initiated by the work of Pasteur and Lister. Although, as already stated, I do not propose to write even a brief history of anesthesia, a few outstanding events should be mentioned in addition to those already referred to, namely, the introduction of cocaine by Koller in 1844, of novocaine by Braun in 1905, of the combination of oxygen and nitrous oxide by Andrews in 1868, the introduction by Alexander Wood in 1853, of the hypodermic syringe, which made possible the rapid advance of the use of local anesthesia, and the important work of Dr. Matas who advanced from the use of local anesthesia in minor surgery to its use in major surgery. Matas soon progressed into the field of regional anesthesia and proceeded so rapidly that in 1900 he published two truly epoch-making papers, one on "The

Growing Importance and Value of Local and Regional Anesthesia in Minor and Major Surgery,"[5] the other on "Local and Regional Anesthesia with Cocaine and other Analgesic Drugs."[6] By 1900 he was able to show that from 50 to 60 per cent of the operations which six years before would have required a general anesthesia could be performed under local or regional anesthesia.

During the period of Dr. Matas's investigations, I had begun researches to discover, if possible, the cause of surgical shock, and had discovered that the phenomena of shock do not follow injuries in territories the nerve supply of which is blocked either by local anesthesia or by a spinal block. My collaborators and I found also that shock is lessened by the administration of morphine, and that it is diminished also by careful handling, sharp dissection and minimum trauma. These investigations, published in 1899,[7] 1901,[8] and 1903,[9] laid the foundation for the combination of anesthetic and surgical methods which we later designated *anoci association*,[10] which is an attempt to protect, anesthetize, all the nerve centers, central and local, this anesthesia contributing not only to the immediate, local comfort of the patient but to his general well-being. Anoci association is accomplished by such a combination of anesthetics, narcotics, environmental management and surgical technique as is suited to the individual case.

While the methods of applying these various means of protection have varied with increasing knowledge and with the introduction of more refined methods of anesthesia, the underlying principle has remained the same: individualization of the patient. In each case, the method used, whether general anesthesia, analgesia, spinal or regional anesthesia, or local anesthesia, each combined with narcosis and general management, is that indicated by the general condition of the patient as well as by the particular lesion.

It should be emphasized that no anesthetic method is standardized. It never can be standardized. That is, no one type of anesthesia is suitable for every type of case.

INHALATION ANESTHESIA

In our opinion, which is based upon studies of the effects of the different anesthetic agents upon the cells of the central nervous system, the lipoid solvent anesthetics, ether and chloroform, are contraindicated in bad risk cases, and that in any case, nitrous oxide-oxygen is the anesthetic agent of choice.

Twenty years ago, I believed that nitrous oxide plus oxygen was the inhalation anesthetic which when combined with local anesthesia provided the greatest protection to the cells of the central nervous system. I still believe that nitrous oxide-oxygen is the inhalation anesthetic of choice, but that only in the exceptional case should even this form of anesthesia be advanced beyond the stage of analgesia. Paradoxical though it may seem, the more serious the risk, the less the amount of inhalation anesthetic that should be administered. It should be borne in mind that bad-risk patients can not with entire safety endure even the mild degree of suboxidation that results from surgical nitrous oxide-oxygen anesthesia. The types of cases of which this is particularly true are starved and toxic cases: cases of obstruction of the pylorus, of cancer of the large intestine and of diseases of the gall bladder and common duct. The danger of complete anesthesia, even with nitrous oxide-oxygen, is especially manifested in cases of severe hyperthyroidism. In all bad-risk cases the anesthesia is harmful to the extent to which it interferes with the internal respiration, especially the internal respiration of the liver, the myocardium, and the brain.

In 1880, Klikowitch employed nitrous oxide-oxygen to lessen the pains of childbirth, and from the time of the old nitrous oxide "frolics" it has been known that minor injuries could be sustained without resultant pain after the inhalation of small amounts of this gas. Nitrous oxide analgesia has long been employed in dentistry and in minor operations. It is a remarkable property of nitrous oxide-oxygen analgesia that the patient, although freed to a considerable degree from pain,

and separated from his emotions, at the same time retains his intellectual control. The state of analgesia can be continued throughout the longest and severest operation on a very sick patient without bad results.

Anesthesia with nitrous oxide-oxygen anesthesia is safe; analgesia is safer. In 1914, Dr. Teter, Miss Hodgins and her associates at Lakeside Hospital had already administered nitrous oxide-oxygen 34,964 times without a fatality,[11] and among the thousands of operations performed since that time in my service at Lakeside Hospital and in the Cleveland Clinic, there has been no fatality. By keeping the degree of anesthesia within the zone of analgesia, the utmost safety is assured. The extreme safety of analgesia is found in the fact that nitrous oxide analgesia does not interfere with the internal respiration of the cells.

## LOCAL AND REGIONAL ANESTHESIA

It has been said that the ancients, especially the Egyptians, possessed agents for the production of local anesthesia. The anesthetic value of the local application of cold has long been known. The compression of nerve trunks as a means of producing local anesthesia was practised by the Arabs, and was used by Paré and by many other operators, both ancient and modern, and in recent years attempts have been made to revive this practice.

In 1853, Alexander Wood, by the introduction of the hypodermic syringe, made possible the application of drugs directed upon the nerve endings; in 1884 Koller demonstrated the anesthetic property of cocaine, the value of which, as an operative aid in minor operations, was shown first by Halsted[12] and Corning.[13] Halsted showed that when cocaine was injected into any part of a nerve trunk, sensory stimuli to any part of its peripheral distribution were blocked. This finding led to the later development of regional anesthesia, the value of which in major operations was later developed by Matas and others.

As Labat[14] has emphasized, a thorough knowledge of anatomy is essential for the successful application of regional anesthesia since the method implies primarily the injection of nerves in all parts of the body. Novocaine, the anesthetic properties of which were first demonstrated by Braun,[15] is the anesthetic agent of choice. Practically any operation on the head may be performed under regional anesthesia. In operations on the neck, local infiltration plus nitrous oxide-oxygen analgesia is most satisfactory. One avoidable objection to the use of regional anesthesia in operations on the neck is that the laryngeal nerves may become paralyzed, this resulting in certain discomfort and possible danger to the patient. The cervical plexus may be blocked, however, for block dissection of the glands of the neck. For operations on the upper extremity, the upper brachial plexus may be blocked, and for operations upon the thorax, such as rib resection, the paravertebral and intercostal nerves may be injected.

My associates and I employ regional anesthesia in combination with nitrous oxide analgesia as an infiltration before the first incision. Splanchnic anesthesia is employed in most operations on the gall bladder and stomach, in internal operations on the appendix, and in certain pelvic operations. Splanchnic anesthesia should be used with caution in operations on the genitourinary tract, as in many cases requiring such operations the patients have an impaired renal function.

It should be borne in mind that the personality of the patient must always be considered. In the case of a nervous patient who is fearful and unduly anxious, it may be necessary to employ local infiltration and nitrous oxide analgesia, or to employ the latter measure with the regional and splanchnic block. If the patient is excitable, it may even be necessary to let the analgesia pass into anesthesia for a brief period.

It is well to emphasize again that the type of anesthesia to employ, or rather the combination of anesthetic methods to employ, depends upon the individual patient. Even the habitus of the patient has some bearing upon the problem as it

is easier to locate the regional centers in patients of the long, lean type.

In the presence of cardiac or circulatory disturbances, or in cases of impaired renal function, regional anesthesia, as has been stated, must be used with caution. The value of spinal anesthesia in such cases will be discussed later.

### SPINAL ANESTHESIA

I believe that Corning was the first to suggest the injection of cocaine into the neighborhood of the spinal cord as an anesthetic method. In 1885 he published his paper on "Spinal Anesthesia and Local Medication of the cord."[13] Corning continued his investigations, and various other authors published papers dealing with different aspects of the problem of introducing medicinal fluids into the subarachnoid spaces. However, it was not until 1899 that the feasibility of spinal anesthesia was finally established by the work of Bier.[16]

According to Gwathmey, the first surgical operation under spinal anesthesia was performed by Tait and Caglieri on October 26, 1899, just ten days after the anniversary of the first public demonstration of ether anesthesia.[17] Originally, the method was used only for operations on the lower extremities. There are various reports of the use of this new method in 1900. In that year, Lower successfully amputated a leg, in a case of diabetic gangrene, under spinal anesthesia, according to the method we had employed in the laboratory for blocking the spinal cord in dogs. Anesthesia was complete, there was no shock, and the patient made a complete recovery.[18]

Spinal anesthesia is of special value in operations in bad-risk cases, when the lower abdomen or lower extremities are involved. Thus, it may be employed to great advantage in amputation of the thigh or hip, in resection of the large intestine or rectum, in cases of obstruction of the bowels, in cases of large ventral or other hernia, especially in obese subjects, in prostatectomy, in resection of the bladder, in certain difficult kidney operations, especially in bad risks. Spinal anesthesia

is not free from danger since it encroaches upon vital functions. It should always be used by experienced operators, the Trendelenburg position must always be employed; the blood pressure must always be controlled. In expert hands, when all precautions are employed, it can be used with safety. Labat[19] lists the principal dangers encountered in the use of spinal anesthesia as follows:

> The higher the *puncture*, the greater the risk of injuring the cord and causing extensive functional disorders. The higher the *level of analgesia*, the greater the danger of severe complications which may result in respiratory failure. The higher the *segmental analgesia*, the greater the risk of upsetting the cardiovascular and respiratory balance, as a result of interference with the extrinsic mechanisms of circulation and respiration.

He says further:

> Puncture of the spine and injection in the cervical and upper dorsal regions being associated with comparatively greater risks than elsewhere, the induction of spinal anesthesia routinely for operations upon the head, neck and thorax unnecessarily increases the burden imposed upon the patient by the operative procedure itself.
>
> The use of spinal anesthesia for such operations as can be performed satisfactorily with other procedures of the regional method introduces into the general practice of surgery undesirable elements in the estimation of operative prognosis.
>
> The induction of general analgesia by subarachnoid block for operations upon the head, neck and upper thorax is out of proportion to the extent of the surgical intervention and is clinically unsound.
>
> The induction of spinal anesthesia for operations below the diaphragm is absolutely safe when all the details of technic are scrupulously observed.
>
> The combination of details of technic taken from different sources is considered unwise and may lead to deplorable results.
>
> Contraindications to the use of spinal anesthesia being based chiefly upon physiologic considerations, it is of the utmost importance that these considerations be well known so as to avoid disaster.
>
> Any technic which is based on the principle of diffusion or gravitation of the injected fluid to the brain introduces into the method one of the biggest adverse factors in the achievement of end-results.
>
> Any technic which implies the injection of solutions precluding the use of the Trendelenburg position immediately after the injection is detrimental to health and may endanger life.

Any technic which involves control of the level of anesthesia in utter disregard for the protection of the patient against acute anemia of the brain is dangerous to life.

Any technic which rests upon the fundamental principle of circulatory disturbances and attempts to cushion by posture the abruptness of such disturbances is of the highest clinical value.

At first we used novocaine in spinal anesthesia, but now we employ the solution introduced by Pitkin: spinocain. In general, we employ Pitkin's technique for its introduction, with the modification suggested by T. E. Jones[20] that we have the patient assume the prone position during the injection of the spinocain. This is done for the reason that since the solution is lighter than the spinal fluid, by this maneuver it is brought more surely into contact with the nerve roots. The field of anesthesia can be followed by lightly pricking the patient. As soon as the anesthesia has extended as far as is necessary for the operation, the patient is turned on his back and placed in the Trendelenburg position at an angle of from 5 to 10 degrees, this position being continued after the operation. This is important as a means of avoiding anemia of the brain as the result of the lowered blood pressure which follows the introduction of the anesthetic into the subarachnoid spaces. We generally make the puncture between the third and fourth interspace.

We have had no deaths which could be attributed to the use of spinal anesthesia. Since it involves vital functions, however, it should always be borne in mind that spinal anesthesia is not free from danger and its use should be accompanied by every precaution. The greatest menace of spinal anesthesia is lowered blood pressure. To obviate this danger, ephedrin in 1 grain dosage is given before the injection of the spinocain, and if necessary the dose is repeated during and even after the operation. Four or 5 drops of adrenalin, although more fleeting in its effects than ephedrin, is more effective, after the spinocain has been injected. The Trendelenburg position will guard the patient from the danger of anemia of the brain due to the lowered blood pressure.

### NARCOTICS

We have referred to the preoperative administration of a narcotic as part of the essential procedure of anoci association. This procedure is particularly important when regional or spinal anesthesia is employed, as it protects the patient from the psychic effects of the sights and sounds in the operating room. We give morphine and scopolamine (morphine ¼ to ⅙ grain, atropine 1/150 grain), at least an hour before the operation, to all patients except the aged, the very young, and those whose feeble condition contraindicates the use of narcotics. Not only does the use of morphine diminish the preoperative and operative strain, but it prevents to some extent the damaging of the central nervous system and the liver by the trauma of the operation. That deep morphinization will almost completely prevent shock has been abundantly proved in both the laboratory and the clinic.

The value of morphine is especially exemplified in cases of severe hyperthyroidism. In those cases of infection in which it is necessary to perform an emergency operation, morphine is especially useful. In such cases, the morphine protects the brain against injury from the infection as well as against trauma from the operation.

A word should be added regarding the use of quinine and urea hydrochloride. When it is probable that there will be much postoperative discomfort, this agent may be injected at a distance from the line of incision, either immediately after the operation, or later, should pain develop. Since we have adopted the use of diathermy as a routine measure during and after extensive abdominal operations, it has rarely been necessary to employ quinine and urea hydrochloride. It should be borne in mind that this drug when injected in the line of the incision produces local edema and thus interferes with healing, so that the dictum *at a distance from the line of incision* should be strictly followed.

SUMMARY

The principle enunciated under the term "anoci association" still holds. The original methods employed have been altered to meet the advancing knowledge established by clinical observations and experimental research.

The scope of regional and of spinal anesthesia is extending; the role of the inhalation anesthetic is being progressively lessened, and when used it is kept as far as possible within the zone of analgesia, or at least, above the zone of the old ether chloroform narcosis.

The principle of anoci association implies such a combination of anesthetic methods: general, local, regional, spinal, of narcotics and general management, as are best suited to the individual case.

Anesthesia, like anoci association, can never be standardized; its application must always be individualized.

REFERENCES

1. Gwathmey, J. T. Anesthesia. Ed. 2, N. Y., Macmillan, 1924.
2. Flagg, P. J. The Art of Anesthesia. Ed. 4, Phila., Lippincott, 1928.
3. Allen, C. W. Local and Regional Anesthesia. Phila., Saunders, 1914.
4. Braun, H. Local Anesthesia. Trans. by P. Shields, Phila., Lea and Febiger, 1914.
5. Matas, R. *Phila. M. J.*, 6: 820, 1900.
6. Matas, R. *Tr. Louisiana Med. Soc.*, 1900, p. 329.
7. Crile, G. W. An Experimental Research into Surgical Shock. Phila., Lippincott, 1899.
8. Crile, G. W. Certain Problems Relating to Surgical Operations. Phila., Lippincott, 1901.
9. Crile, G. W. Blood Pressure in Surgery. Phila., Lippincott, 1903.
10. Crile, G. W., and Lower, W. E. Anoci Association. Phila., Saunders, 1914.
11. Hodgins, A. The technic of administering nitrous oxide anesthesia. Appendix to Anoci Association, by G. W. Crile and W. E. Lower, *loc. cit.*, p. 245.
12. Halsted, W. S. *New York M. J.*, 42: 294, 1885.
13. Corning, J. L. *New York M. J.*, 42: 317, 1885.
14. Labat, G. Regional Anesthesia. Ed. 2., Phila., Saunders, 1928.
15. Braun, H. *Deutsch. med. Wchnschr.*, 31: 1667, 1905.
16. Bier, A. *Deutsch. Ztschr. f. Chir.*, 51: 361, 1899.
17. Gwathmey, J. T. Anesthesia. Ed. 2, N. Y., Macmillan, 1924, p. 559.
18. Lower, W. E. *Cleveland J. Med.*, 5: 118, 1900.
19. Labat, G. *Am. J. Surg.*, n.s. 5: 675, 1928.
20. Jones, T. E. *M. J. & Rec.*, 132: 226, 1930.

# TOTAL RHINOPLASTY*

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THE art of reconstructing a nose destroyed by certain tuberculous or syphilitic lesions, through trauma or surgical amputation, is as old as surgery itself.

FIG. 1.

When the destruction is partial and affects only the wings of the nose, or the lower septum, small cutaneous strips may be taken from the neighboring tissues; when these are sound, but

* For original French text see p. 309.

when the entire nasal structure must be replaced, a total rhinoplasty is required, necessitating the taking of a considerable portion of skin from a distant quarter.

FIG. 2.

There are two classic methods of procedure. The first is derived from the Indian method. It consists in removing from the forehead a broad strip, provided first of all with cartilage and having a pedicle attached to the intersuperciliary region. This strip is then pivoted about its own pedicle in order to lower it and to adapt it to the freshened-up substance at the point of loss. This procedure has the drawback of leaving ugly scars on the forehead.

The second procedure, derived from the Italian method, consists in taking a strip of skin from the arm, which is held flexed on the head by a special apparatus. This process has the

FIG. 3.

double drawback of being unpleasant for the patient and of furnishing a strip of skin which both in texture and hue contrasts unpleasantly with the color of the face.

The procedure which I have gradually developed and which I now employ is derived jointly from the Indian and the Italian methods, with the added principle of strips with double tubulated pedicles, in the manner suggested by my lamented teacher, Morestin, and of Gillies, of London.

This procedure assures better nutrition of the strip, which is taken from the central portion of the forehead above the

roots of the hair, and which may be lowered directly by means of two tubulated temporal pedicles. After nutrition of the graft is assured, one needs only to cut the pedicles and restore them

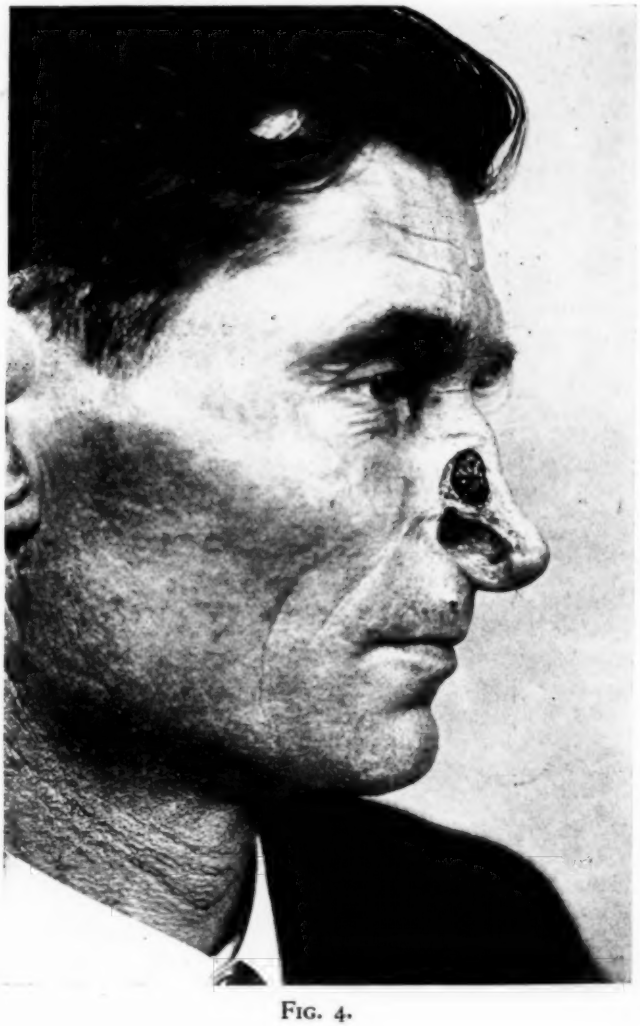

FIG. 4.

to their place. The scars are hidden in the hair and this rhinoplastic method may therefore be regarded as the least disfiguring.

The principle of the method consists, therefore, in preparing the pedicles beforehand by suturing their two edges one to the

other. This preliminary rolling of the pedicles, converts them into genuine tubes, and will later facilitate considerably the irrigation of the graft. The graft is later cut between the two

FIG. 5.

tubulated pedicles; the blood supply is thus conducted directly to it without suffering damage along its course.

### OPERATIVE TECHNIQUE

1st Session. This comprises preparation of the two temporal pedicles, which are cut and tubulated, care being taken not to injure the trunk of the temporal artery at their base. The pedicle is cut by means of two parallel incisions, freed along its

entire length, and then tubulated, and the two edges sutured to each other. The cut surface resulting from the severing of the pedicle should be covered with iodoform gauze and the

FIG. 6.

dressing renewed as infrequently as possible. According to conditions, one or both of the pedicles may be prepared at a single sitting.

2d Session. Eight to ten days later, dissection and removal of the frontal strip is accomplished with reservation of a small median quadrilateral for the lower septum and two lateral

FIG. 7.

ailerons for the wings of the nose. (Fig. 1.) Freshening-up of the periphery of the loss of nasal substance and cutting of a small median strip as an upper joint, or hinge, to be attached to the small frontal strip, is next done, followed by the placing of the frontal strip, pivoted on its two temporal pedicles.

3d Session. When, after two weeks, the nutrition of the strip seems assured through its own blood supply, the two pedicles may be cut successively, with an interval of a few days, and placed in position, after being split and spread out and after the edges of the loss of cranial substance have been freshened up and freed. By stretching the pedicles gently, it is possible to cover up almost entirely the loss of substance, the central portion of which closes, either spontaneously or through the annexing of a dermo-epidermic lamella.

4th Session. This comprises adaptation and modeling of the strip by successive retouching with the aim of trimming and rounding the wings of the nose so as to render the nasal orifices permeable. It is, moreover, necessary for several months to leave rubber tubes in the nostrils until their interior epidermization is complete.

The wings of the nose, according to the case, should be completely molded and rolled up as far as the lower septum, or merely sutured to the root of the normal wing, if the latter has been spared by the trauma.

Among the necessary retouchings, depilation of the transplanted strip is important. In the effort to insure extirpation of the hairs, I have abandoned the use of *x*-rays and electrolysis and employ a surgical method of depilation which seems to me simpler and more radical. This method consists simply in destroying the pilous bulbs by means of a sharp curette and scissors curved to the lower face of the strip. This extirpation should be carried out in successive sessions, either before lowering the graft, or at the time of the definite adaptation of the graft.

It is preferable not to leave cartilage attached to the strip, but later to introduce a small piece of cartilage into the body of the graft, if the latter tends to give way.

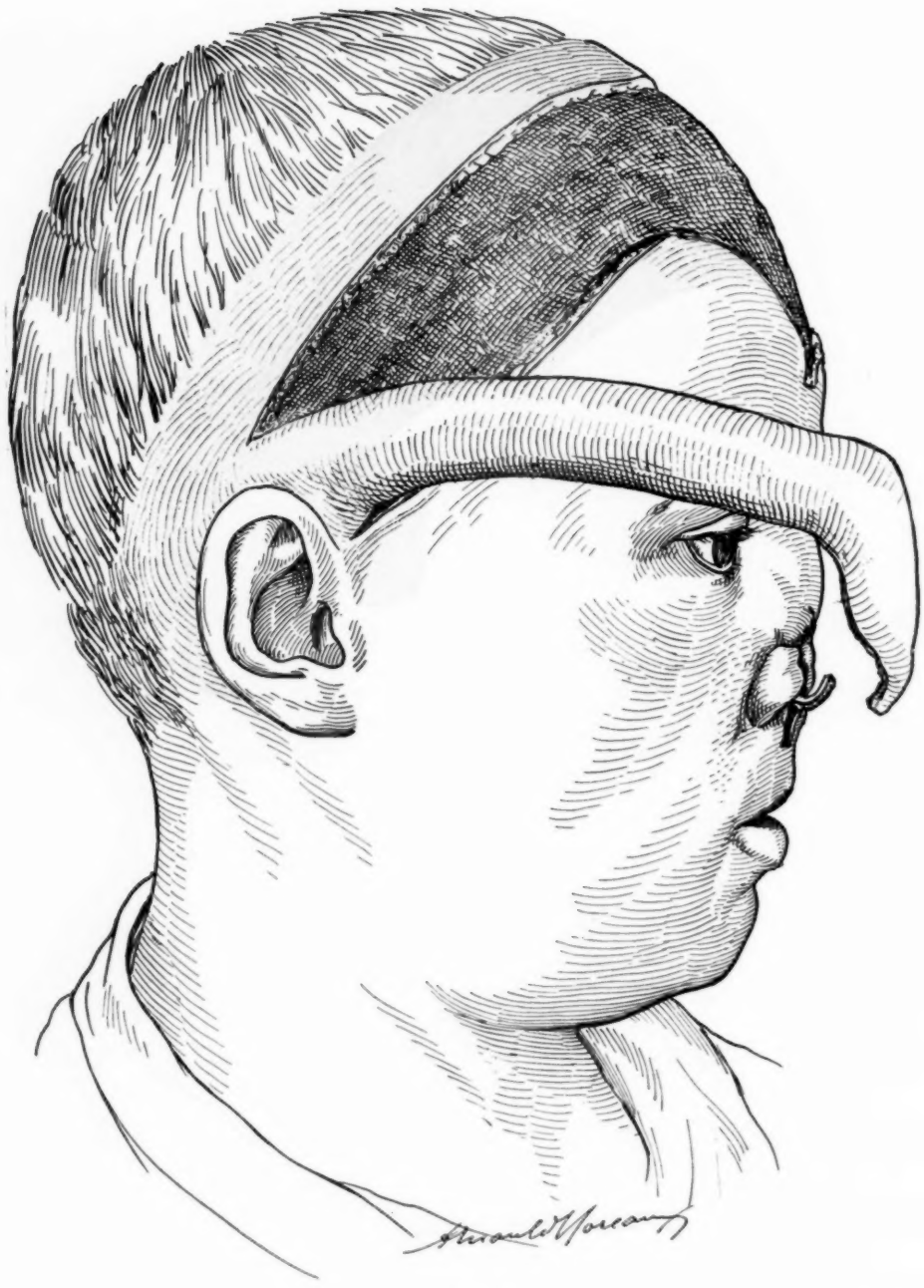

FIG. 8.

FIG. 9.

The results obtained by this procedure are satisfactory.

Total or subtotal rhinoplasty, by the method of a median frontal strip, with double tubulated pedicle always involves five or six operative sessions which may be carried out under local anesthesia. Three to four months must be allowed for its complete execution.

# LA RHINOPLASTIE TOTALE*

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L'ART de refaire un nez détruit par certaines lésions tuberculeuses ou syphilitiques, par un traumatisme ou par une exèrèse chirurgicale, est aussi vieux que la chirurgie.

Lorsque la destruction est incomplète et porte seulement sur les ailes du nez ou sur la sous-cloison, on peut emprunter de petits lambeaux cutanés prélevés sur les tissus voisins lorsqu'ils sont sains; mais lorsqu'il faut remplacer toute la pyramide nasale, la rhinoplastie totale doit emprunter un vaste lambeau de peau prélevé au loin.

Deux procédés demeurent classiques: le premier est dérivé de la méthode indienne. Il consiste à prélever sur le front un large lambeau, armé au préalable de baguettes cartilagineuses et dont le pédicule siège dans la région intersourcilière; à faire pivoter ce lambeau autour de son pédicule pour le descendre et l'adapter sur la perte de substance avivée. Ce procédé a l'inconvénient de laisser sur le front de vilaines cicatrices.

Le deuxième procédé, dérivé de la méthode italienne, consiste à prélever le lambeau cutané sur le bras maintenu en flexion sur la tête par un appareil spécial. Ce procédé a le double inconvénient d'être très incommode pour le patient et de fournir un lambeau de peau dont le grain et la couleur tranchent désagréablement sur la couleur du visage.

Le procédé que j'ai mis progressivement au point et que j'emploie actuellement, dérive de la méthode indienne et de la méthode italienne, empruntant, en outre, le principe des lambeaux à doubles pédicules tubulés, à la facon de mon regretté maître Morestin et de Gillies de Londres.

* For English Translation see p. 298.

Ce procédé assure une meilleure nutrition du lambeau qui est taillé sur la partie moyenne du front, à cheval sur la racine des cheveux, et qui peut être descendu directement à l'aide de deux pédicules temporaux tubulés. Lorsque la nutrition du greffon est assurée, il suffit de sectionner les pédicules et de les remettre en place. Les cicatrices sont ainsi dissimulées dans les cheveux et ce procédé de rhinoplastie peut, de ce fait, être considéré comme le moins mutilant.

Le principe de cette méthode consiste donc à préparer les pédicules dans un temps préliminaire, en suturant respectivement l'un à l'autre leurs deux bords. Cet enroulement préalable des pédicules transformés ainsi en véritables tubes va favoriser considérablement l'irrigation du greffon qui sera taillé ultérieurement entre les deux pédicules tubulés, car le sang lui sera conduit directement sans subir aucune perte le long de sa route.

### TECHNIQUE OPERATOIRE

1er Temps—Préparation des deux pédicules temporaux qui sont taillés et enroulés en ménageant à leur base le tronc de l'artère temporale.

Le pédicule sera taillé à l'aide de deux incisions parallèles, décollé dans toute son étendue, puis enroulé, et ses deux bords seront sutures l'un à l'autre. La surface cruentée résultant de la taille du pédicule sera recouverte de gaze iodoformée et le pansement renouvelé le moins souvent possible. On peut, suivant les cas, preparer dans la même séance un seul ou les deux pédicules.

2ème Temps—Huit à dix jours après, dissection et décollement du lambeau frontal en ménageant un petit quadrilatère médian pour la sous-cloison et deux ailerons latéraux pour les ailes du nez (Fig. 1).

Avivement de la périphérie de la perte de substance nasale et taille d'un petit lambeau médian à charnière supérieure qui sera opposé au petit lambeau frontal.

Mise en place du lambeau frontal basculé autour de ses deux pédicules temporaux (Fig. 2).

3ème Temps—Lorsque, après quinze jours, la nutrition du lambeau parait assurée par son irrigation propre (Fig. 3), on peut sectionner successivement l'un et l'autre pédicules à quelques jours de distance et les remettre en place après les avoir fendus et étalés et avoir avivé et décollé les bords de la perte de substance cranienne. En les étirant légèrement, on arrive à recouvrir presque entièrement cette perte de substance dont la partie centrale se ferme soit spontanément, soit par adjonction d'une lamelle dermo-épidermique.

4ème Temps—Adaptation et modelage du lambeau par des retouches successives qui ont pour but de tailler et d'enrouler les ailes du nez afin de rendre perméables les orifices narinaires. Il est d'ailleurs nécessaire de laisser durant plusieurs mois des tubes de caoutchouc dans les narines jusqu'à leur complète épidermisation intérieure.

Les ailes du nez seront, suivant les cas, complètement façonnées et enroulées jusqu'à la sous cloison, ou seulement suturées avec la racine de l'aile normale lorsque celle-ci a été ménagée par le traumatisme.

Parmi les retouches nécessaires, il est important d'épiler le lambeau cranien transplanté. Pour obtenir la chute définitive des poils, j'ai renoncé aux rayons X et à l'électrolyse, pour employer un moyen chirurgical d'épilation qui me parait plus simple et plus radical. Ce moyen consiste simplement à détruire les bulbes pileux, à l'aide d'une curette tranchante et der ciseaux courber par la face profonde du lambeau. Cette destruction doit s'effectuer par temps successifs, soit avant de descendre le greffon, soit au moment où l'on procéde à l'adaptation esthétique définitive du greffon.

Il est préférable de ne pas armer le lambeau de cartilage et de glisser ultérieurement une petite baguette de cartilage dans l'épaisseur du greffon s'il a tendance à s'affaisser.

Les résultats obtenus par ce procédé sont satisfaisants.

La rhinoplastie totale ou subtotale par le procédé du lambeau frontal médian à double pédicule tubulé, comporte, toujours cinq ou six temps opératoires qui peuvent s'exécuter à l'anesthésie locale. Il faut compter environ trois à quatre mois pour son exécution complète.

# FISTULAS FOLLOWING THE MARSUPIALIZATION OF HYDATID CYSTS

## THEIR RADIOGRAPHIC EXAMINATION*

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BARCELONA

THE stubborn biliary fistulas that remain as the result of the opening and marsupialization of hydatid cysts are much more frequent than would be desired. This occurs especially in infected cysts in which no other procedure can be carried out and these are the most difficult to treat.

In the simple uninfected cysts, even when the marsupialization is used, these fistulas are less frequent, as in these the cholerrhagia during the first days following operation has a marked tendency to spontaneous healing because the fistula is produced by the rupture of the small biliary channels, some of them microscopic.

This easy healing contrasts with the numerous fistulas that we observe after operation on cysts that have ruptured into the biliary tract or have suffered any infection coming from the same tract.

The mechanism of the persistent cholerrhagia in these stubborn fistulas is due to various causes, among which we mention the two most important:

1. The fistula may be due to an obstacle in the main passage: the common duct.

2. The fistula may be due to a pathologic communication of the cyst cavity with a biliary channel of gross diameter.

The study of the causes and the diagnosis of their nature and localization can be made now, not only by clinical and laboratory findings, but by means of radiographic study of the biliary tract after the injection of lipiodol.

*Translated by Dr. John Rodick and Dr. Loyola. For original Spanish text see p. 323.

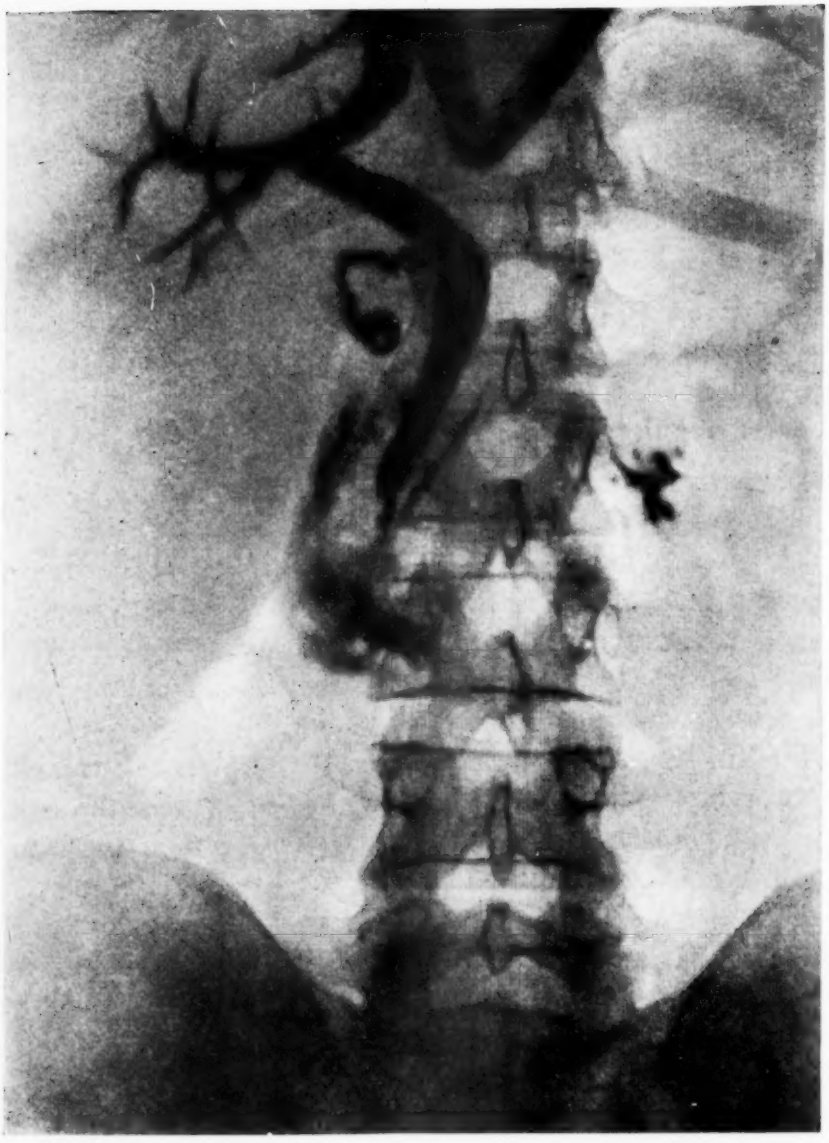

FIG. 1. Lipiodol has penetrated freely up to duodenum, outlining clearly intrahepatic tracts, and shows cystic duct, duct of Wirsung, and other large ducts without any cyst remains.

1. *Fistulas from Obstruction of the Main Channel:* The compression is most frequently originated by intact hydatids or remaining membrane which act as a tampon of gelatinous consistency and obstruct the choleduct and partially the hepatic duct. This obstruction is rather frequent, since rupture into the biliary channels can be considered as one of the most common accidents.

When these hydatids issue from the cyst that has been evacuated and marsupialized, they disappear rapidly, the obstruction being temporary, since there are numerous discharges through the choleduct and papilla of Vater which are accompanied by a more or less accentuated clinical picture during which the hydatids can be demonstrated by straining the feces.

Notwithstanding, the principal passage does not always remain clear in spite of the discharge but at times the obstruction persists; this is demonstrated by persistent acholia, and at times by the same jaundice which had diminished with the opening of the operated cyst, and in all these cases we should think of the possibility of the existence of other cysts also opening into biliary tracts which may continue supplying the sacs that constitute the obstruction of the principal passage. It is always worthy of consideration that the proliferation of the cysts is reactivated when they come in contact with the bile, and there is noticed in most of the cases an increase in number of the daughter cysts lying by the side of the dead cysts. Lozano of Zaragoza, who has so wide an experience in hydatid disease, because it is very frequent in the country where he works, believes that the parasite is biliophilic, but we are rather inclined to believe as more probable in a proliferative reaction of defense which, undoubtedly, overcomes the not less evident toxic action that the bile has on the parasite.

The obstruction is not always intrinsic; we have had occasion to observe compression of the main duct by extrinsic pressure caused by a cyst located somewhere at the spigelian lobe or at the quadrate lobe.

FIG. 2. Same patient seen in profile.

2. *Fistulas without Obstacle in the Main Biliary Duct:* In some cases, the biliary fistula persists, although we cannot find, after the marsupialization, any obstacle in the biliary channels. In fact, we can obtain bile by the duodenal tubage; the feces are more or less colored with bile, and notwithstanding this, the fistula has no tendency to heal. It is true that in these cases, we can almost always control the cholerrhagia temporarily with a tight tampon of the fistulous tract, but nevertheless the fistula persists indefinitely causing great despair to the patient and marked worry to the surgeon. The roentgen examination in these cases shows a free communication of the cyst with the biliary tract without alteration in its form and direction, and the lipiodol passes freely to the duodenum through the ampulla of Vater.

*Clinical Exploration of Biliary Fistulas following the Marsupialization of an Hydatid Cyst:* We should employ, at first, the methods which may give a certain orientation. The investigation of the presence of bile in the feces or the straining of these to look for hydatid membranes, could cause us to think of an obstruction of the biliary ducts provided that the lack of bile in the feces and the presence of membranes remain constant. Nevertheless the hydatid tampon may allow some bile to pass and the hydatids may be unnoticed on account of its being inconstant.

The radiological exploration, on the other hand, will give us much more positive information.

After several observations of Lanari and Squirru,[2] of Cotte and Badolle,[3] of Lefevre Monties[4] in 1925 and of several other authors at present, we have used systematically lipiodol injection in all fistulas following marsupialization, and in every case we have had definite evidence of the conditions which caused the persistent cholerrhagia.

When there is an obstacle in the main duct, it is observed that the lipiodol stops when it reaches the obstacle with a level more marked than that produced by a stone, which may be seen sometimes in the radiograph.

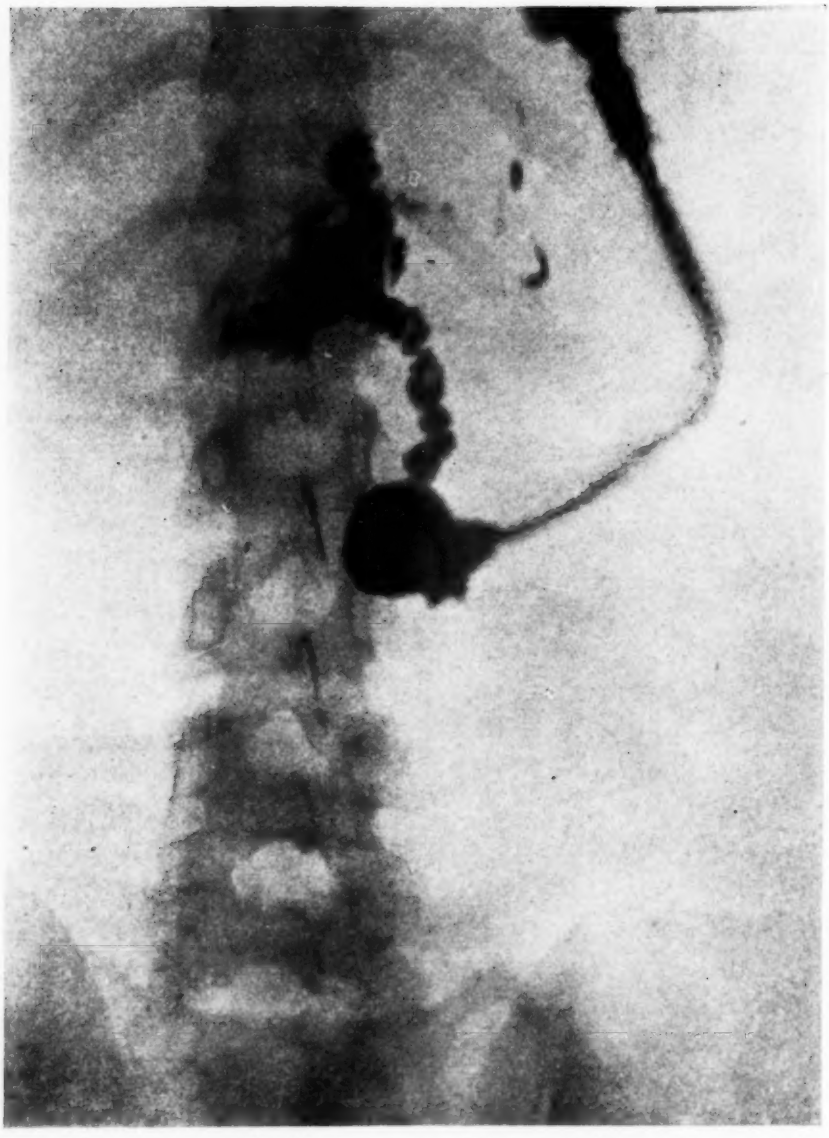

FIG. 3. Lipiodol enters gall bladder by means of Pezzer catheter, then passes through cystic duct and after filling junction between large intrahepatic ducts comes to rest at choleduct which is impermeable because of retained membranes.

When the choleduct is free, we see the lipiodol passing easily into the duodenum; this does not happen with all the bile, which can not force the sphincter of Oddi, if there is communication with a bile duct of large diameter.

As an example of the usefulness of the radiographic examination in these cases, we reproduce four radiographs:

The first and the second belong to a patient, thirty years old, who had a pyopneumocyst, with fetid pus, and at the end of one year, still had intense cholerrhagia by the orifice of the marsupialization. Both anteroposterior and lateral radiograms show clearly that the lipiodol passes easily to the duodenum, and we found the biliary ducts normal regarding their form, diameter and direction. This patient was treated by making the closure of the fistulous tract in the same way that an intestinal fistula is closed; the patient was cured in a few days.

The third and fourth radiographs are of a woman who presented a clinical picture of acute cholecystitis after childbirth, and notwithstanding her jaundice was treated only by cholecystostomy since the gravity of her condition did not permit of more prolonged intervention. The patient improved but not entirely, the bile continuing to flow from the fistulous tract without any of it passing into the intestine. After the radiologic exploration preceded by lipiodol injection, there was found a complete obstruction of the choleduct. When the patient was operated upon, the choleduct was opened and numerous hydatids came out, some partly disintegrated and others alive, which formed a gelatinous tampon which hermetically sealed the lumen of the choleduct. Drainage was established in the choleduct but the original cyst from which the obstructing hydatids arose was not found. The patient died and at necropsy a hepatic cyst was found which did not elevate the surface of the liver even though it was not very deep.

Certainly the patient would have survived if, instead of draining the choleduct, we could have performed a cystostomy with marsupialization of the cyst which was also suppurative.

FIG. 4. Same case, radiograph taken laterally.

### SURGICAL TREATMENT OF BILIARY FISTULAS FOLLOWING MARSUPIALIZATION OF HYDATID CYSTS

Following radiologic findings, we are able to determine the logical treatment.

1. *Cases in Which There Is No Obstruction in the Main Channel:* In this case we close the cyst or the biliary channel which it represents with a technique similar to the one employed in radical treatment of artificial anus.

In one of the patients operated upon by us under these conditions, the cyst had a tubular form united to the skin in the form of a rigid tube with a narrow lumen; once the skin was closed by a purse string suture we could dissect the tube formed by the remains of the cyst wall, section it, suture it in various planes, cover it with peritoneum and leave it united to the wall with incomplete closure, in case breaking down should occur.

2. *Cases in Which the Radiograph Indicates an Obstruction in the Principal Passage:* There has been much discussion among surgeons over the preferable method of treating the jaundice from obstruction by the ecchinococcus. The opening of the choleduct, so highly recommended by the French surgeons to evacuate the principal bile tracts as a prime indication, here loses a great part of its value because of the existence of the cholerrhagia which makes the drainage unnecessary. Furthermore as the result of our observations, we are firmly convinced that always after the opening of the cyst the obstruction in the choleduct persists a long time, which indicates the repeated passage of new hydatids supplied by an unevacuated cyst. Multiple cysts are very frequent and the persistence of the obstruction usually means the existence of an undiscovered cyst which acts as an inexhaustible source of new hydatids which travel through the biliary passages. We should also remember that cysts are not always visible by abdominal exploration nor even by laparotomy, so that in no case should we neglect the exploration of the dome of the right diaphragm because the alteration and modification of its form

may, in some cases, indicate the existence of a suprahepatic cyst.

All these cases should be approached through the pleura and diaphragm, as especially studied by Petridis, to reach the hepatic abscesses, as it is the only sufficiently guaranteed way to approach the posterior and superior regions of the liver.

The evacuation by means of cystotomy as upheld by our South American colleagues is the only radical effective intervention to secure relief of the obstruction of the choleduct in a definite manner.

## CONCLUSIONS

1. The persistence of cholerrhagia after marsupialization of hydatid cysts depends upon two causes: the prolonged indefinite existence of hydatids in the choleduct or the opening into the cyst of a large biliary channel.

2. Only radiography of the fistulous tract, after lipiodol injection, can give us assurance of the cause which maintains the cholerrhagia since clinical examination is not always definite.

3. The prolonged persistence of hydatids in the choleduct nearly always indicates the presence of an unevacuated cyst and the only treatment which offers any guarantee is the evacuation of the cyst.

4. When the cholerrhagia depends upon the opening of a large intracystic biliary channel, the treatment should be like that for radical cure for artificial anus.

## REFERENCES

1. Lozano. Algunos problemas de la equinococia. Libro homenaje al Doctor Goyanes.
2. Lanari and Squirru. *Rev. de la Asoc. med. Argentina*, p. 125 (Sept.) 1924.
3. Cotte and Badolle. *Cociedad de Cirugia de Paris*, p. 759, 1925.
   Cotte. *J. de Chir.*, 34: 759.
4. Devé. *J. de Chir.*, 26: 605, 1925.
5. Finochietto. *Bol. y trab. de la Soc. de Cir. de Buenos Aires.* p. 464 (Aug.) 1924.

# LAS FISTULAS CONSECUTIVAS A LA MARSUPIALIZACIÓN DE LOS QUISTES HIDATIDICOS: SU EXPLORACIÓN RADIOGRAFICA*

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LAS fistulas biliares rebeldes que quedan como cosecuencia de la abertura y marsupialización de los qustes hidatídicos, son mucho mas frecuentes de lo que seria de desear. Es precisamente en los quistes infectados, en los que nos está vedado emplear otros procedimientos, en los que se presentan estas fistulas con mayor dificultad para su curación.

En los quistes simples, *no infectados*, aun empleando la marsupialización son poco frecuentes estas fistulas, ya que en ellos la *colerragia* de los primeros dias despues de operados, tiene una marcada tendencia a la curación expontánea, por estar producida por la ruptura de pequeños canaliculos biliares, algunos de ellos microscópicos.

Contrasta con esta facilidad de curación el número de fistulas que observamos despues de operar quistes que han sufrido un accidente de ruptura en las vias biliares o una infección cualquiera de las mismas.

El *mecanismo* de la persistencia de la colerragia, constituyendo estas fistulas rebeldes, obedece a diversas causas, entre las cuales distinguiremos dos principales.

*Primera*. La fistula puede ser debida a un obstáculo de la via principal hepato-coledociana.

*Segunda*. La fistula puede ser debida a una comunicación patológica de la cavidad quística con un conducto biliar de grue so calibre.

El estudio de estas causas y el diagnóstico de la naturaleza y localización de las mismas, podemos hoy dia efectuarlas no

* For English translation see p. 313.

solo por los signos clínicos y de Laboratorio, sino principalmente por medio del estudio radiografico de las vias biliares previa la inyección de lipiodol en el interior de las mismas.

*Fistulas por obstrucción de la via principal.* La compresión estará originada las mas de las veces por hidátides enteras o por restos de membranas que a modo de tapón de consistencia gelatinosa obstruyen el colédoco y parte del hepático.

Esta obstrucción es bastante frecuente, ya que la ruptura dentro de las vias biliares, puede consideraase como uno de los accidentes mas frecuentes.

Cuando estas hidátides proceden del quiste que ha sido evacuado y marsupializado, se agotan rapidamente, siendo la obstrucción *temporal*, ya que nunca faltan varias desgargas coledoco-vaterianas, que van acompañadas de un cuadro sintomático mas o menos acentuado en el cual podemos comprobar la *hidatidenteria* por el tamizado de las heces.

No obstante no siempre queda libre el conducto principal a pesar de dichas descargas, sino que a veces persiste la obstruccion que se demuestra por la persistencia de la acolia, a veces de la misma ictericia, que habia disminuido con la abertura del quiste operado y en todos estos casos debemos pensar en la posibilidad de la existencia de otro quiste abierto tambien en vias biliares que vaya renovando las vesiculas que constituyen el obstáculo de la via principal. Es siempre digna de tenerse en cuenta la reactivación prolígera de todo quiste que ha sido puesto en contacto de la bilis, notándose en la mayor parte de los casos el aumento de vesiculas hijas, al lado de vesiculas muertas. Lozano de Zaragoza,[1] que tiene gran experiencia en hidatidosis, por lo frecuente que es esta enfermedad en la región que ejerce, habla de una *biliofilia* del parásito, pero nosotros nos in clinamos a creer que mas bien se trata de una reacción proliferativa de defensa, que indudablemente sobrepasa a una, no menos aevidente accion tóxica, que la bilis ejerce sobre el parásito.

No siempre la oclusión sera interior, pues hemos tenido ocasion de observar compresiones de la via principal por

presión extrinseca ocasionada por un quiste localizado en un punto del lóbulo cuadrado o del de Espigelio.

*Fistulas sin obstáculo en la via principal de las vias biliares.* En algunos casos, persiste la fistula biliar, sin que se pueda encontrar despues de la marsupializacion, ningun obstáculo en las vias biliares. En efecto, por sondaje duodenal se puede obtener bilis, los excrementos están coloreados, con mayor o menor intensidad y sin emba bargo, la fístula no tiene ninguna tendencia a la curación. Cierto que en estos casos casi siempre podemos yugular temporalmente la colerragia con un taponamiento apretado del trayecto, pero de todos modos la fistula persiste indefinidamente, con gran desesperación del enfermo y marcada preocupación del cirujano. El exámen radiográfico en estos casos nos demueszra una amplia comunicación del quiste con las vias biliares sin que exista alteracion en la forma y direccion de las mismas, pasando libremente el lipiodol al duodeno, a traves de la estrechez vateriana.

*Exploracion clinica en las fistulas biliares, cosecutivas a una marsupialización por quiste hidatídico.* El problema a dicidar en estos casos es la causa de la persistencia de la *colerragia.*

Utilizaremos ante todo los metodos clinicos que nos pueden dar una cierta orientación. El examen de bilis en las heces y el tami zado de las mismas en busca de membranas, nos podrán orientar a suner un obstáculo de vias biliares siempre que la falta de materia biliares o la presencia de hidátides se presente de un modo repetido. No obstante, el tapón hidatidico, puede permitir pasar cirtt cantidad de bilis y la hidatidenteria siendo intermitente, puede pasar iadvertida.

El método radiográfico nos dará por el contrario, datos de mucha mayor seguridad. Despues de varias observaciones de Lanari y Squirru,[2] de Cotte y Badolle[3] de Lefevre Monties[4] el año 1925 y de varios mas en la actualidad, hemos procedido sistematicamente a la inyección con lipiodol de todas las fistulas consecutivas a las marsupializaciones y en todos los casos hemos obtenido un resultado muy evidente respecto a

las condiciones que originaban la patogenia de la persistencia en las colerragias.

Cuando existe un obstáculo en la via principal, se observa que el lipiodol, queda detenido a nivel del mismo, con un límite mas marcado que el que produce un cálculo que puede a veces ser apreciado por la misma radiografia.

Cuando el conducto principal está libre, vemos que el lipiodol pasa al duodeno con facilidad, lo que no ocurre con toda la bilis, que no puede forzar el esfinter de Oddi si hay una comunicación con un grueso conducto biliar.

Como ejemplo de lo demostrativo que resulta en estos casos el examen radiográfico, acompañamos las siguientes radiografia. La primera y segunda corresponden a un enfermo, de unos 30 años que tenia un pio neumo quiste, con pus fétido que al cabo de mas de un año todavia tenia una intensa colerragia a nivel del oricio de marsupialización. La radiografia tanto frontal como de lado, nos indican claramente que el lipiodol pasa al duodeno con la mayor facilidad, encontrandose unas vias biliares normales en cuanto a su forma, calibre y dirección. Dicho enfermo fue tratado por medio de la oclusión operatoria del trayecto fistuloso como si se tratase de una fistula intestinal, saliendo curado de la misma a los pocos dias.

Las radiografias tercera y cuarta pertenecen a una mujer que presentó un cuadro de colecistitis aguda despues de un parto y apesar de su ictericia fué tratada tan solo por colecistostomia ya que su estado de gravedad no permitia otra intervención mas prolongada. La enferma mejoró, pero no del todo, persistiendo la sal ida de bilis por el trayecto fistuloso, sin que pasase nada por el intestino. Efetuada la exploracion radiológica previa inyección de lipiodol, se aprecia una obstrucción completa de todo el coledoco. Operada la enferma, se abre el coledoco y salen numerosas hidátides, en parte esfaceladas y en parte vivas, que forman un tapón gelatinoso que ocluye hermeticamente la luz del coledoco. Se establece undrenaje del coledoco y no se encuentra el quiste originador

de las hidatides obstructivas. La enferma fallece y en la necropsia se aprecia un quiste hepatico que no produce relieve en la superficie del higado apesar de no ser muy profundo.

Seguramente la enferma se hubiera salvado si en vez del drenaje de coledoco hubiesemos podido practicar una quistotomia con marsupialización del quiste, que por cierto era *suprado.*

*Tratamiento quirurgico de las fistulas biliares consecutivas a la marsupializacion de los quistes hidatídicos.* Despues de los datos proporcionados por el examen radiografico podemos plantear el tratamiento de un modo 'lógico.

I°. *Casos en los que no hay obstáculo en la via principal.* En este caso cerraremos el quiste o el conducto biliar que lo substituye con una técnica parecida a la que se emplea en el tratamiento radical de un ano contranatura.

Uno de los enfermos operados por nosotros en estas condiciones, tenia el quiste una forma tubular unido a la piel en forma de tubo rígido co una luz estrechada: una vez cerrada la piel en bolsa de tabaco, pudimos disecar el tubo formado por los restos de las paredes del quste, seccionarlo, suturarlo en varios planos, cubrirlo de epiplon y dejarlo unido a la pared, con cierre incompleto, por si sobrevenia una dehiscencia de la misma.

2°. *Casos en los que la radiografia indica un obstaculo en la via principal.* Mucho se ha discutido entre los cirujanos sobre el metodo preferente para tratar las ictericias por obstrucción en la equinococia. Lax abertura del coledoco recomendada con gran calor por los cirujanos franceses[4] para evacuar la via bilias principal como indicación primordial, pierde aquí gran parte de su valor, por existir una colerragia que suple dicho drenaje. Ademas como consecuencia de nuestras observaciones, tenemos el convencimiento arraigado de que siempre que despues de la abertura de un quiste persiste el obstaculo coledociano durante mucho tiempo, es indicio del paso renovado de *nueva hidátides* procedentes de un *quiste no evacuado.* Son muy frecuentes los quistes múltiples y la persistencia del

obstáculo, traduce las mas de las veces la existencia de un quiste desconocido que actua como manantial inagotable de nuevas hidátides que se vierten por las vias biliares. Debemos tambien recordar que no siempre loss quistes son perce tibles por la exploración abdominal ni siquiera por laparotomia, así que en ningún caso debemos descuidar la exploración de la bóveda diafragmatica derecha que por su alteración y modificación de forma nos indicará en algunos casos la existencia de un quiste supra hepatico.

Todos estos casos requeriran ser abordados precisamente por la via transpleuro-diafragmática, preferentemente estudiada por Petridis para abordar los abcesos hepáticos, pues es la única que nos ofrece garantias suficientes para abordar esta región posterior y superior del higado.

La evacuación por medio de la quistotomia como sostienen nuestros colegas sud americanos,[5] es la unica intervencion radical y eficaz para conseguir una desobstrucción del coledoco de carater definitivo.

Conclusiones. 1ª. La persistencia de la colerragia despues de la marsupialización de los qustes hidatidicos, depende de dos causas. La existencia prolongada e indefinida dehidátides en el conducto coledoco, o la abertura intraquistica de un grueso coducto biliar.

2°. Solo la radiografia del conducto fistuloso previa inyección de lipiodol nos puede dar la seguridad de la causa que mantiene la colerragia ya que el examen clínico no siempre es decisivo.

3ª. La persistencia prolongada de hidátides en el coledoco casi siempre indica la presencia de un quiste no evacuado y el solo tratamiento que ofrece garantas es la evacuacion del mismo.

4ª. Cuando la colerragia depende de la abertura de un grueso conductillo biliar intraquistico, el tratamiento será parecido al de la cura radical de un quano-contranatura.

# PLACE OF THE SENSES IN THE DEVELOPMENT OF SCIENCE

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ORTHODOXY has its value. Unless a person is deeply interested in a search for truth in a special field, it is better for him to keep an open mind and, with "a decent respect for the opinions of mankind," travel with the majority, that his energy may be conserved to develop the work in which he has been trained. If he wishes to devote his life to a study of so-called psychic phenomena, it is one thing, but as a side line investigation of the occult carries distinct danger to integrity of thought. It loosens the mind from the moorings of fact, gives predominance to the lesser senses, and creates emotional disturbances which resemble the instinctive fear reactions of primitive man and the lower animals. One of these reactions was fear in the dark, which remains with us today as a source of emotional disturbance.

Man first recognized only enemies that were large enough to be seen and dangers that could be estimated visually, such as wild beasts, serpents and tempests. Against phenomena which he could not understand he invoked the protection of his gods.

Through association of ideas the words *cult* and *occult* have become closely allied. The cultist devotes his energy to spread a special belief not recognized by the majority as resting on a sound foundation. The occultist devotes his time to an attempt to elucidate a belief in hidden and mysterious powers having their origin in a spirit world and to subject them to human control.

Anyone dabbling in the occult, deliberately depriving himself of vision, man's chief means of obtaining information, injures himself mentally. It is a curious ego that in the clear

light of reason will prompt one to say of a certain subject, "I do not understand this," and in the dark of suggested psychic influences to say of the same subject, "I believe this is occult," in the sense of a mysterious spirit force. I have known a number of men of great promise in medicine who in the springtime of their lives became interested in a cult or in occultism of the old-fashioned spiritualistic type, which led them to unproved or unprovable hypotheses, blind alleys of belief. As a result, they lost their keen perception of fact and made little progress in their profession.

Sir Conan Doyle in his masterly characterization of Sherlock Holmes intrigued the interest of hosts of readers and established a school of detective fiction. Sir William Crookes, the last of the great all-around physicists, made investigations which led to the discovery of the cathode ray, the basis of the *x*-ray. Sir Oliver Lodge, who so clearly placed before the interested but untrained student the fundamental facts in physics, has the gratitude of all. These are three outstanding men of science who interested themselves in psychic phenomena and believed in reincarnation of the dead. This interest, however, came in the autumn of an intense scientific life. Their great days were over. The new interest was a foil to the critical research of the early days, like the contemplative philosophy of the Orientals.

There is a divine discontent with the existing order of things which leads to progress. Youth is always insurgent, a builder of images, a dreamer of dreams. When guided by scientific imagination youth builds images to be compared with known facts, and dreams true dreams. Age carries mental scars left by experience which contract and shorten vision, but age carries wisdom. Youth and age should travel together; each needs the other for orderly scientific advancement.

The man of 100 years ago who would have attempted to talk about radio and the wireless would have been regarded as mentally deranged. Had he been able to produce these phenomena they would have been considered occult manifestations from

the spirit world, and he probably would have been burned at the stake. Whenever we do not understand existing phenomena, let us lay the lack where it belongs, to the failure of understanding which the future may clear up, and not allow ourselves to prostitute intelligence by talking about fairies, ghosts, spirits, and reincarnation of the dead.

Science is organized knowledge of the physical world. Wisdom denotes a clear perception of facts and sound judgment in dealing with them. The man of science in searching for the truth must ever be guided by the cold logic of facts, and be animated by scientific imagination. Man's brain, the instrument devised to receive and interpret truth, depends on the senses as its main avenues of approach through which come the raw materials of the truth. Only as the accuracy of these special senses in transmitting the materials out of which truth is made, can be relied upon, can the resulting truth be relied upon. Science, therefore, owes much to the special senses. It seems fitting to pause in these days of the supremacy of science, to consider these special senses.

I shall, therefore, devote the remainder of this paper to two topics; first a consideration of the genesis and relative value of the special senses in obtaining information, and second the significance of vision in the evolution of one of the sciences, namely medicine.

## THE SPECIAL SENSES

The brain of man, a social being, is dominant. It records and classifies impressions, analyzes experiences, and activates emotions.

Intellectual functions cannot be ascribed entirely to the special senses, but are rather the sum total of both external and internal sensory impressions woven into a complex mechanism controlling behavior.

The upper brain which contains the cerebral convolutions is the central organ which connects man with the outside world. This part of the brain might be picturesquely described as an

expansion of the primitive organ of the sense of smell, but this expansion has been devoted to vision whereas the sense of smell has diminished. The higher mammals, and especially man, have achieved direct pathways from the eyes to the cerebral convolutions, and the growth of the mind, so far as man is concerned, might be said to be coincidental with the development of vision. Stimuli of the sense of taste, of hearing, and of touch must figuratively pass through more relay centers to reach the brain, and therefore their interpretation may be inaccurate and misleading unless corrected by sight, just as a telephone message relayed through several stations may be garbled.

In the simplest forms of life external impressions are conveyed through the protective covering of the organism. In the invertebrate, the amphioxus, all the sense organs other than tactile are rudimentary or absent. The sense of touch, a pressure sense, is the most primitive of the special senses. In common parlance, touch refers to the hands, which the upright position of the human body has freed for highly specialized training.

At the Victoria Hospital in Newcastle-on-Tyne that sound English surgeon, Rutherford Morison, whose observations have been characterized by vision and acumen, has printed on the wall of his operating room facing his students, five words: "Sight," in large letters; "Touch," in smaller letters; "Hearing," in still smaller letters; "Smell," in fine print, and last "Taste," in print so small as to be scarcely distinguishable across the room, thus indicating his estimation of the five special senses in relation to surgery.

### THE SENSE OF TASTE

The sense of taste is a chemical sense and in man is the least important of the special senses and the most imperfect. This sense is closely associated with the sense of smell, and most of the qualities known as flavors, prized by the epicure, are distinguished by the sense of smell, rather than by

the sense of taste. Without the sense of smell, the sense of taste cannot distinguish an onion from an apple. The sense of taste developed early, that the primitive organism might be able to recognize material unfit for food as well as edible material, and in man this sense has so little discrimination that it can detect only four types of food: sweet, sour, salty, and bitter.

### THE SENSE OF SMELL

The sense of smell is also a chemical sense, extraordinarily accurate and highly developed; it detects odors which are entirely beyond discovery by any known scientific apparatus. Gases, and vapors representing material in a molecular or colloid state not only can be recognized but also correctly classified by the trained sense of smell. This sense, however, does not give appreciation of time, place, or motion.

The sense of smell depends on certain cells which end in a hair. These cells are arranged in small bundles about the base of which are pigmented cells. Newer knowledge of physics in connection with the radio, little as it is, gives a clue to the purpose of the hair endings. These delicate hairs may be compared to the antennae of a radio, recognizing the impact of electronic vibrations of rapidly moving colloids and unstably oxidized molecular substances suspended in the air as odors, just as the eyes recognize various wave-lengths of light as colors.

In man the organ of smell is situated deep and occupies a total area of only about one square inch. The relation of the sense of smell to the protection of the organism against poisonous contacts seems to depend on the pigmented cells at the base of the organ of smell. Sheepmen will not raise albino lambs but send them to the butcher, because they have no sense of smell and sooner or later would die from eating poisonous material.

The sense of smell, unlike the senses of sight and hearing, does not diminish with age, but often becomes more acute, and is keener in women than in men.

In the lower vertebrates smell is the only special sense that comes by direct pathways to the upper brain and is dominant in controlling behavior, meaning the relations of one animal to another of the same or a different species.

With the wind in the right direction, the distance at which a deer is able to detect danger by the characteristic odor of an enemy is almost incredible. And yet the infant deer during the first days of life is without odor, protected in some curious way against its enemies in the stage of its innocence. Wild beasts passing near will not discover the fawn, but will trail the mother.

In certain breeds of dogs, as the hounds, the organs of smell are enormously developed, but their sight is defective. The bird dog circles the object of his search, depending on the sense of smell for approximate location. He then points the cover of the game from the intensity of the odor, and finally secures sight of the object. A hound following a scent may run into a tree during the chase, and may bark at his master, unable to recognize him by sight at a distance of 100 feet.

### THE SENSE OF HEARING

The sense of hearing in man is inaccurate. Whereas the senses of sight and smell will telephone, so to speak, directly to the brain, a sound to reach consciousness must be relayed through a number of extra stations, with all the possibility of confusion and inaccuracy that the process necessarily entails.

Fish have a sixth sense, situated in the lateral line organ of Leydig, which gives the sense of pressure, depth, and equilibrium, and from this labyrinth organ of the water vertebrate the organ of hearing in land animals developed. The ear of land animals responds to sound waves and pressure changes in the air as the lateral line organ of water vertebrates does to waves and pressure changes in water.

The inaccuracy of hearing due to the relay system of transmission of sound to consciousness is illustrated by the difficulty in estimating the source of a sound. When a person hears a

church bell ringing in an unknown locality, he is uncertain not only as to the direction but also as to the distance and volume. Is it a large bell ringing at a long distance, or a small bell ringing close by?

At one time some children at my house were playing a little game in which each child in turn was blindfolded and two coins were struck together about eighteen inches from the head. The children when blindfolded were almost totally unable to tell from what direction the sound came.

Helmholtz, sixty years ago, called attention to the hair on the organ of Corti and expressed his belief that their varying lengths might have to do with distinguishing tones. Little importance seems to have been attached to these hair endings. One is impressed with the modern radio and its antennae as a possible explanation of the hair endings of the organ of the sense of hearing as well as of the sense of smell, and the principles which underlie their function. One might say that these hairs are antennae acted on by electronic energy connected with changing air pressure which enables the individual to listen in, as the radio enthusiast would express it.

## THE SENSE OF SIGHT

In the higher mammals, among which man is dominant, vision has secured direct pathways to the upper brain, and the sense of sight, giving comprehension of space, time and motion, has overborne the sense of smell. Pressure changes in the surroundings affect touch and hearing; changes in radiant energy affect the eyes. The mechanism of the human eye is in some respects inferior to that of the eye of some of the lower animals. With the telescopic vision of the eagle, man could read fine print at 500 feet.

Certain fishes in the depths of the sea radiate cold light, not necessarily connected with the eye, but emanating from specialized cells in various parts of the body, differing according to the habits and necessities of fish life, which makes possible a certain amount of vision. Cold light is also seen in

the glow-worm, the fire-fly and other animals. Much research is being carried on to determine the nature of this light, in the hope that it may be used instead of the hot light obtained by present-day methods of oxidation.

The eyes of many of the lower vertebrates have separate vision, and in only two diameters, length and breadth. The higher mammals, for instance man, with binocular vision, see in three diameters, length, breadth, and depth.

One hardly need call attention to the fact that it is not the mechanism of the eye of man which is triumphant, but its relation to the intelligence of man.

While the sense of sight is dominant among the special senses, owing to its accuracy, it is remarkable that those who lose this sense in infancy can, with training, substitute for it the senses of hearing and touch. Helen Keller is an example of an intelligence of high order developed largely from the sense of touch. We must remember, however, that in this training the teacher's sense of sight takes the place of that of the pupil. The intelligence is there, but it is not efficient until trained. The ear-trained and touch-trained blind man would not be so easily deceived in the dark by the faker as the eye-trained man suddenly placed in the dark, who would be more likely to be controlled by his ancient emotion of fear in the dark. Memory can be spoken of as mental photography.

The sight of man is not quick, and on this fact was based the old adage, "The hand is quicker than the eye." It must be borne in mind, however, that the hand in question is the hand of a prestidigitator educated by the eye.

## VISION THE PREDOMINANT FACTOR IN THE EVOLUTION OF THE MEDICAL SCIENCES

In studying the history of medicine it is significant that in the 10,000 years of Egypt's history there were no less than eight complete relapses into barbarism, and there is little of value to scientific medicine in the meager records of those times.

Medicine began with the earliest peoples as an appeal to the emotions through occultism, and here originated the cults, which still abide with us. New cults come as the fraud of the old ones is exposed.

Scientific medicine had its beginning in the fourth century before the Christian era with Hippocrates, who founded clinical medicine, and with his near contemporary, Aristotle, who developed deductive reasoning and a primitive form of inductive logic, on which science rested securely for 2,000 years. The great school at Alexandria with its museum and library founded by the Ptolemies in the third century B.C., was the center of learning. Here the students of Aristotle developed and gave to the world the priceless gift of scientific methods. In the eleventh century Abelard founded scholastic education, in the thirteenth century the first university was established. In the sixteenth century Francis Bacon introduced into philosophy inductive reasoning. William Harvey, contemporary of Bacon, applied inductive reasoning to medicine and by experimentation established physiology on a sound basis. In this great Elizabethan or Shakespearean century came also the first of the physician-chemists, John Mayow, whose investigations led to the discovery of oxygen. In 1590, the Janssens brought out the microscope, an invention which was to revolutionize science. The present day microscopic limit is 1/10 micron or 1/250,000 of an inch.

The invention of the microscope increased the power of vision and made possible the epochal work of Pasteur which led to the popular recognition of the rôle of microörganisms in the causation of disease, with the result that the scourges of contagion, infection, and infectious diseases, which could be survived only by persons with natural or acquired immunity, have nearly disappeared. Scientific medicine has advanced more in the last fifty years through the extension of vision by means of the microscope than in all previous time. This is demonstrated by the illustrious work of Pasteur, Virchow,

Lister, Gorgas, and other eminent men of science who have created, so to speak, health and prolongation of life.

We see, as through a partially opened door, new gifts to man, through further extensions of vision into the submicroscopic field, which includes particles 1/1,000 micron or 1/25,000,000 inch in diameter. The romance and adventure of modern research lie in this ultramicroscopic realm.

In the years from 1803 to 1844 Dalton promulgated the atomic theory and investigated the constitution of the molecule, with so few instruments of precision that the exactness of his results bordered on the miraculous. As the result of the most extraordinary improvements in methods which are ultimately visual, knowledge has been gained of the field of the colloids as well as the molecule and the atom.

Sir William Bayliss has well said that there is no line of demarcation between physics and chemistry. In other words, it is only under certain physical conditions that those alterations in the atomic constitution of molecular bodies, which we speak of as chemical changes, take place.

The ray of light travels 186,000 miles a second. When the ray of light is refracted, as by colloid bodies, it is resolved into rays of various lengths and speeds which are recognized by the retina of the eye as colors. The longest ray appears as red, and in order of the length of the rays, orange, yellow, green, blue, and violet are seen. On the relative length of these rays the colorimetric system in medicine is based. With the *x*-ray the molecule and atom can be analyzed.

Photography plays a great part in fixing for deliberate study with the eye objects in rapid motion. One twelve-millionth of a second is sufficient to make a photograph which will show a bullet in flight at a muzzle velocity of 3,000 feet a second as though it were standing still.

A remarkable fact is that colloids, molecules, atoms, electrons and protons, unlike particulate substances which are microscopically visible, remain in rapid motion more or less permanently suspended in their medium in spite of the force

of gravity, although all are affected by pressure, temperature, and atmospheric conditions. Only under certain physical conditions can the electric exchange of electrons and protons in the atomic field of the molecule take place.

Moseley, Thompson, Bohr, Milliken, and other great men working in the field of pure science have developed methods of analysis which give new insight into the practice of medicine and have enabled a critical analysis of the functions of bodily organs. From colloidal chemistry there is now being built a new physiology of man and a better understanding of vital phenomena. Today, in certain instances, restoration of the sick can be as precisely accomplished in the living body as similar chemical changes in the test tube.

In the sixteenth century the average lifetime of man was twenty years. The microscope has given us knowledge of the cause, cure and prevention of disease, thereby increasing the average lifetime of man to fifty-eight years. Investigations of the ultramicroscopic field which we are now entering give promise of increasing the average lifetime to the scripture age of three score and ten.

# SPLENECTOMY

## ITS INDICATIONS AND TECHNIQUE

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THERE are few procedures in surgery which are girt about with such interesting problems as is the operation of splenectomy. The removal of an organ, the functions of which are not yet fully understood and the enlargements of which are beset by such intricate and varied blood dyscrasias, is in every case a fascinating experiment and offers a field for the most intimate cooperation between the surgeon and the hematologist. I do not propose in this paper to discuss the operation as carried out for traumatic rupture, for parasitic infections such as malaria or syphilis, or for the rare cysts and tumors which involve the organ. I shall limit myself to its use in splenomegaly associated with definite blood changes, and endeavor to define the indications for its successful employment in such cases.

Whilst splenic enlargement, and that often to a notable degree, is usually an important element in the case for splenectomy, it cannot be emphasized too strongly that it is the complete blood picture which is the decisive factor in the decision for or against the removal of the spleen in any given case. Thus in a case of marked anemia with gross splenic enlargement, if the bone marrow be not capable of throwing new red cells into the circulation, splenectomy will be ineffective, and, on the other hand, in purpura where blood platelets are deficient or absent, the removal of a relatively small and impalpable spleen may lead to a striking recovery. It behooves us, therefore, to define clearly what data, revealed by blood examination, are essential to a determination that splenectomy is a rational, and will be in all probability a successful procedure.

The introduction of the method of vital staining and the reticulocyte count have marked a striking advance in the selection of cases. If by the vital staining method the blood be shown to contain large numbers of reticulocytes or young red cells in the presence of well-marked anemia with splenic enlargement, we may safely argue that a competent bone marrow is doing its best to make good for excessive red cell destruction, and that in the latter process the large spleen is in all probability playing a leading part. If, therefore, we remove the spleen we may hope for a rapid rise in the red cell count and corresponding clinical improvement. If, on the other hand, the reticulocyte count is low and the anemia progressive, aplasia of the bone marrow is present and splenectomy offers little chance of bettering the patient's condition. A reticulocyte count should, therefore, be an essential preliminary to a decision regarding operation.

The platelet count is also of the first importance, not only in chronic purpura but in splenic anemia, for it is precisely in cases in which the platelet count is low that splenectomy offers most hope of success.

The three conditions in which splenectomy promises real relief are: splenic anemia, hemolytic jaundice and chronic purpura. I propose to illustrate by typical case records what we may hope to accomplish by surgery in these three diseases.

## SPLENIC ANEMIA

It must be confessed at once that the cause of this disease is unknown. What we do know is, that associated with an anemia in which the red and white counts and the hemoglobin are all low, we have an enlargement of the spleen which reaches usually to somewhere between the costal margin and the umbilicus. The spleen is firm and has a rounded margin. Adhesions to the diagram are not the rule—in my experience are very rare unless infarction has occurred. The disease runs a very chronic course which is apt to be punctuated by hemorrhages from the stomach or, less commonly, the bowel. A high

portal blood pressure would appear to be the outstanding feature of the disease and accounts not only for the endophlebitic thickening which is sometimes encountered in the splenic vein, but also for the siderotic nodules met with throughout the spleen, these being the result of hemorrhages into the splenic pulp. Fibrotic changes in the liver are the usual accompaniment of the splenic changes and in old-standing cases the liver cirrhosis may dominate the picture and result in ascites and swelling of the lower limbs. We have as yet no proof that there is in the spleen any parasitic or toxic process which governs the pathological changes. We have, however, clinical proof that in a number of cases removal of the spleen is followed by a notable improvement in the blood picture and the clinical state of the patient.

The operation in this group of cases is not, as a rule, a difficult one. The spleen can usually be mobilized readily if the standard technique is followed, and the splenic vessels are, in my experience, not unduly fragile or brittle.

The following is a typical case:

CASE I. Mr. R. S., aet. thirty-three, draftsman. *Complaint:* weakness, mental depression, breathlessness and hemorrhage from the bowel. *Duration:* four years.

Illness began insidiously with a feeling of weakness and loss of interest in his work, with occasional shivering attacks accompanied by slight jaundice. Two years ago he had a hemorrhage from the bowel and when examined he was found to have an enlarged spleen. The weakness got slowly but steadily more pronounced and two weeks ago he was admitted to the medical side of the hospital.

*Examination:* He was somewhat pale and was mentally depressed. The spleen was enlarged extending to within half an inch of the umbilicus. The liver was palpable just below the right costal margin. No free fluid in the abdomen.

*Blood:*

| | |
|---|---|
| R.B.C. | 3,700,000 |
| W.B.C. | 3,400 |
| Hb. | 70 per cent |

No abnormal red cells, fragility normal.

A diagnosis of splenic anemia was made and operation recommended.

At operation numerous enlarged veins in the abdominal wall were encountered. The spleen was greatly enlarged with a mottled and pale surface and not adherent. Many large veins were seen in the gastrosplenic omentum and coursing over the splenic flexure of the colon. The liver had a morocco leather-like surface and showed early but definite cirrhosis. After mobilization the spleen was removed in the usual manner. It was noted that the splenic vein was friable from endophlebitis.

The immediate recovery was uneventful. His color improved and two weeks after operation the blood count was:

| | |
|---|---|
| R.B.C. | 6,640,000 |
| W.B.C. | 7,000 |
| Hb. | 74 per cent |

*Pathological Report:* Spleen weight 2 lbs. 3¾ oz. Marked thickening of capsule and fibrosis in stroma with siderotic nodules.

He returned to work two months later in good health and spirits and three years later reported well and with a normal blood count.

An interesting point now arose. He was eligible for promotion for a higher and pensionable post in the Civil Service but the Medical Board would not certify him as a fit man in view of the uncertainty of the ultimate prognosis and life expectancy in such cases. When consulted on the matter I agreed with their decision.

The ultimate prognosis is difficult to give with assurance. Whilst it may be said that with the removal of the spleen we have enhanced the patient's prospects of health and comfort very greatly, it cannot be asserted that we have cured him, and for life insurance purposes he will not be accepted as a first-class risk.

## HEMOLYTIC JAUNDICE

In this disease, in which be it noted, jaundice is frequently by no means the outstanding feature, splenectomy is of proven value. Anemia is the characteristic feature and icterus is variable and often extremely faint. The absence of bile in the urine, its presence in the stools, a more or less profound anemia, the fragility of the red blood cells when tested with hypotonic saline, the positive indirect Van den Bergh reaction, the moderate enlargement of the spleen, and, most important of

all the presence of a large number of reticulocytes in the blood, indicate an active production of red cells which are perishing in great numbers.

Two types are usually described, the familial or congenital, and the acquired. Whilst the blood changes in each are essentially the same, in the acquired type the blood destruction is more massive and acute and the prognosis correspondingly more grave. It is sometimes a matter of some difficulty to decide in which of the two categories an individual case must be placed. From the practical point of view this is not of great significance as when the anemia and its associated disabilities threaten the patient's well-being and economic usefulness, and active treatment is called for, we know that splenectomy is of equal efficacy on both types. The fragile red cells fall a prey to the reticuloendothelial cells in the spleen and are destroyed in great numbers. The comforting demonstration of numerous reticulocytes in the blood gives us a confidence that removal of the spleen will permit of these young red cells reaching maturity and, further, we have some evidence to show that with the sacrifice of the spleen the fragility of the red cells is diminished although it does not disappear. The results of splenectomy are striking, lasting and most gratifying. The disappearance of the jaundice, the increase in the red cell count and hemoglobin, and the access in energy and well-being all proclaim the fact that the spleen was playing an active rôle in blood destruction.

The following is a typical case:

Case II. Mrs. A. S., aet. forty-nine. For five years she had complained of intermittent attacks of epigastric pain not related to the taking of food. She also complained of flatulence and breathlessness. One year ago she became weak and more breathless and it was noted that her skin had a yellow tint. She was treated as a case of pernicious anemia with liver extract but without improvement. From time to time her weakness and breathlessness became aggravated and at such times she was definitely jaundiced. Some months ago she felt a lump in the left side of her abdomen. This has since increased in size. Latterly she has been confined to bed owing to increasing weakness.

*Family History:* No history of jaundice in parents or grandparents. One sister was said to have catarrhal jaundice and her son has had jaundice but proved negative to tests for hemolytic jaundice.

*Examination:* The patient was fairly deeply jaundiced. Urine bile free; stools colored. The spleen was enlarged to the level of the umbilicus with a firm, hard margin and readily palpable notch.

*Blood Examination:*

| | |
|---|---|
| R.B.C. | 1,300,000 |
| W.B.C. | 8,700 |
| Hb. | 19 per cent |
| Reticulocytes | 80 per cent |
| Platelets | 201,000 |

Stained films showed many nucleated red cells, no poikilocytosis.

Fragility increased, .55, control .45

Van den Bergh Test. Direct positive, biphasic.

Indirect strong positive.

Icteric index, 25.

Coagulation time nine and one half-minutes.

A diagnosis of acquired acholuric jaundice was made and splenectomy recommended.

On the two nights preceding operation 5 c.c. of 10 per cent calcium chloride were given intravenously and during the induction of anesthesia 30 c.c. of 30 per cent sodium citrate were given intramuscularly.

*Operation:* Through a left paramedial incision a very large, non-adherent spleen was removed. The liver appeared normal. The gall bladder, which was full of gallstones, was left undisturbed. There was practically no hemorrhage and no transfusion was necessary. Following operation the patient developed bronchopneumonia, but in spite of this made a good recovery.

Figure 1 shows the blood changes following operation.

*Pathological Report:* Spleen weight 2 lbs. 2½ oz., dark in color, marked free iron reaction. Numerous granules of hemosiderin pigment visible. Pulp spaces intensely congested; large macrophages containing pigment.

Typical hemolytic jaundice in an active phase.

This case shows the value of the reticulocyte count in such conditions. The presence of nucleated red cells had led originally to a diagnosis of pernicious anemia but no individual could continue anemic with 80 per cent of reticulocytes unless gross red cell destruction was going on. It showed further that a

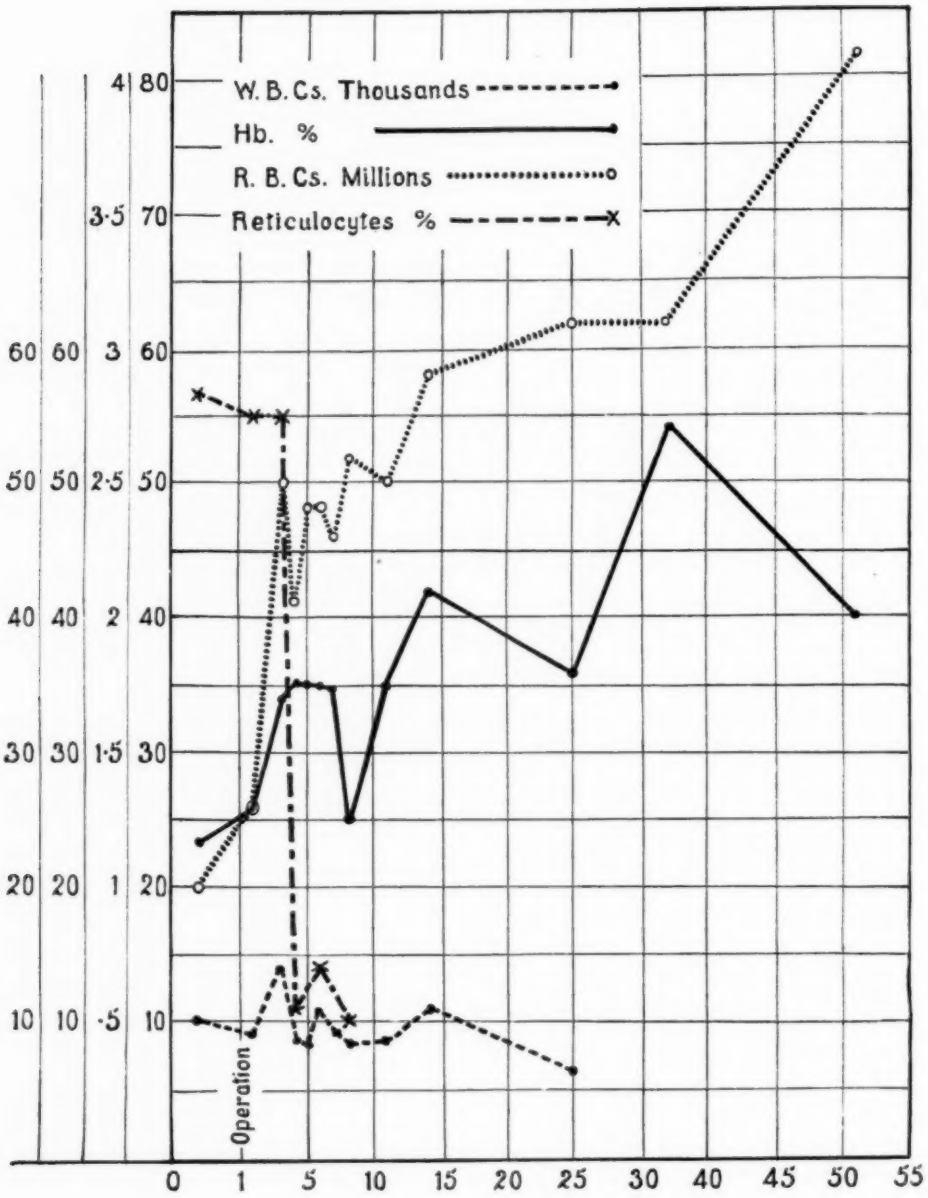
W. B. Cs. Thousands
Hb. %
R. B. Cs. Millions
Reticulocytes %
Operation
4 80
3·5 70
60 60 3 60
50 50 2·5 50
40 40 2 40
30 30 1·5 30
20 20 1 20
10 10 ·5 10
0 1 5 10 15 20 25 30 40 45 50 55

FIG. 1.

splenectomy must almost certainly be helpful. That the spleen was not alone responsible for the blood destruction, however, was shown by the fact that five weeks after operation there were still 6 per cent of reticulocytes in the red count.

### CHRONIC PURPURA

Although the most recent addition to the list of diseases successfully treated by splenectomy, purpura offers perhaps the most striking results. Kaznelson in 1916 was the first to recommend the operation and in the past fourteen years some 200 cases have been recorded in which it has been carried out. At the outset emphasis must be laid on the fact that purpura is a symptom and not necessarily a disease. There is a clinical entity, however, which we term chronic purpura or purpura simplex, which is characterized by recurring hemorrhages into the skin and from the mucous surfaces, which, starting as a rule in childhood, recurs at intervals and may threaten life. The two factors which appear to be operative in determining the hemorrhages are a congenital weakness of the capillary wall and a marked diminution or absence of blood platelets. A prolonged bleeding time is always present but with this is a normal clotting time and a failure of the clot to retract. If a Bier's elastic bandage be applied to the arm multitudes of petechiae appear on the forearm and hand.

It is known that removal of the spleen always leads to an increase in the platelet count. Kaznelson, believing that in chronic purpura platelets were formed in normal numbers but were destroyed by over-active phagocytosis in the spleen, recommended splenectomy as the rational line of treatment. The results of the operation have amply fulfilled his prediction.

The following is a typical case of chronic purpura treated by splenectomy:

Case III. Madge B., aet. fourteen. Since infancy patient has had a tendency to excessive bleeding on slight injury, e.g. when aged seven she had an abscess opened and continued to bleed from the small incision until her life was in danger and transfusion was necessary. Frequently there

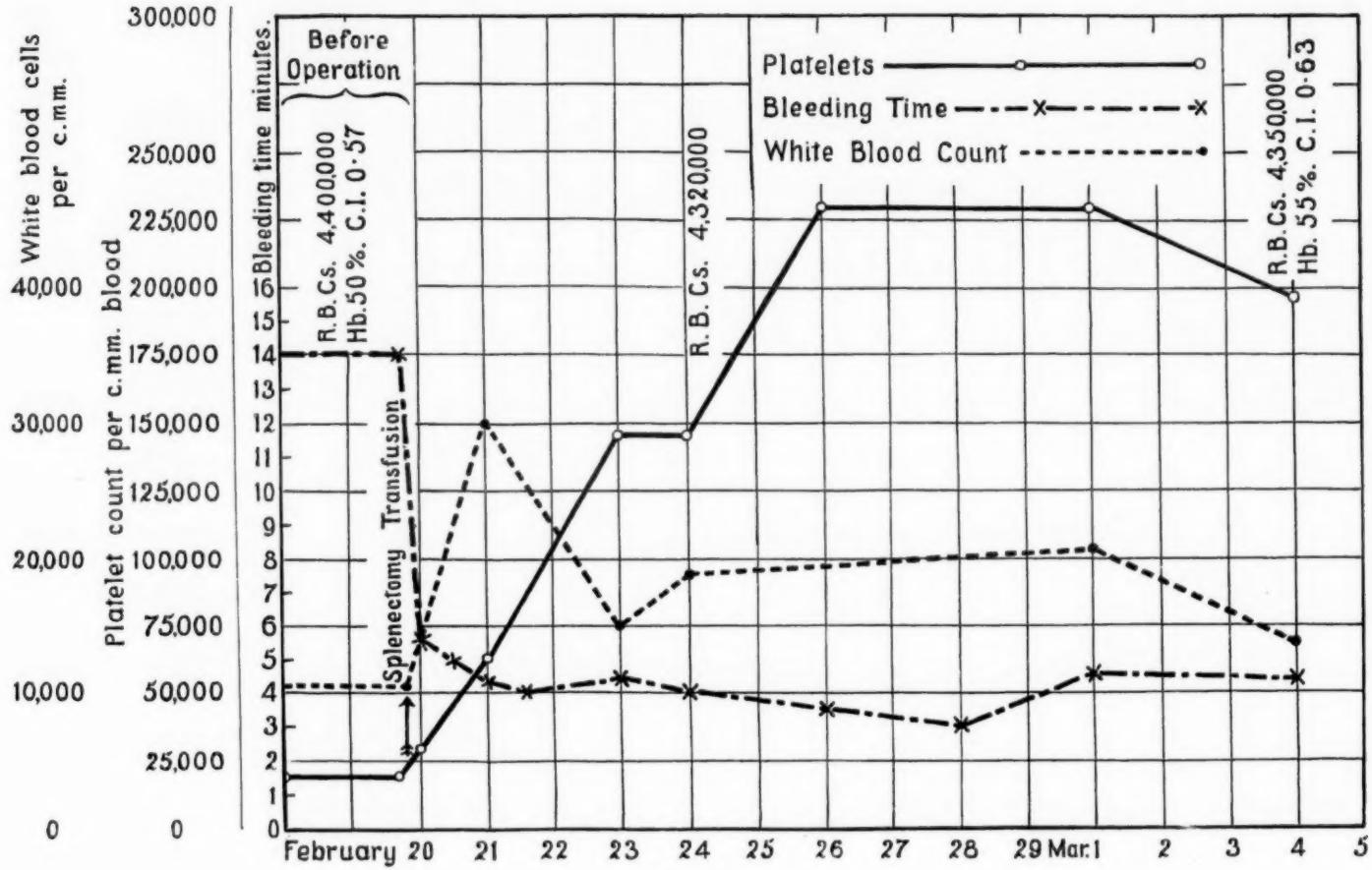
White blood cells per c.mm.
Platelet count per c.mm. blood
Bleeding time minutes.
Before Operation
R.B.Cs. 4,400,000 Hb.50%. C.I. 0·57
Splenectomy Transfusion
R.B. Cs. 4,320,000
R.B.Cs. 4,350,000 Hb. 55%. C.I. 0·63
Platelets
Bleeding Time
White Blood Count
February 20 21 22 23 24 25 26 27 28 29 Mar. 1 2 3 4 5

FIG. 2.

has been spontaneous bleeding from the nose and gums. Crops of purpuric spots have frequently been noticed. Her first menstrual period began on January 7, 1928. She continued to bleed, and was admitted to hospital thirteen days later exsanguine. The uterus was packed and bleeding arrested. No family history of purpura. Whilst recovering from the severe hemorrhage patient developed purpuric spots on the trunk and limbs. She was transferred to a surgical ward four weeks after the uterine hemorrhage. She was then pale but not grossly anemic. A few purpuric spots remained. The spleen was not palpable but the splenic dulness was slightly enlarged.

*Blood Examination:*

| | |
|---|---|
| R.B.C. | 4,600,000 |
| W.B.C. | 10,200 |
| Hb | 50 per cent |
| Platelets | 18,000 |
| Bleeding time | 14 minutes |
| Coagulation time | 3½ minutes |
| Fragility | normal |
| Film | typical of secondary anemia. |

On applying a Bier's bandage round the upper arm innumerable purpuric spots appeared over the forearm and hand.

*Diagnosis:* Purpura simplex.

*Operation* was carried out on February 20, 1928. A spleen, slightly enlarged (weighing 3½ oz.) was removed and 400 c.c. citrated blood transfused.

*Patbological Report:* Spleen slightly enlarged. No notable pathological change visible.

Recovery rapid. A slight attack of tonsillitis caused a temporary leucocytosis. Figure 2 shows clearly the rapid rise in platelets and diminution of bleeding time.

Two weeks after operation a Bier's bandage applied to the arm produced no purpuric spots. Two years later patient reported in robust health. There had been no further bleeding, menstruation was normal and the tendency to bruising on slight injury had disappeared.

## THE OPERATION

In textbooks of operative surgery no operation is described so inadequately as splenectomy. Whether the spleen be normal in size or grossly enlarged there are certain points in anatomy which must be appreciated if its surgical removal is to be

rendered easy and safe. The organ lies very deeply in the left hypochondrium and is maintained in position by the lienorenal ligament up to the medial border of which run the

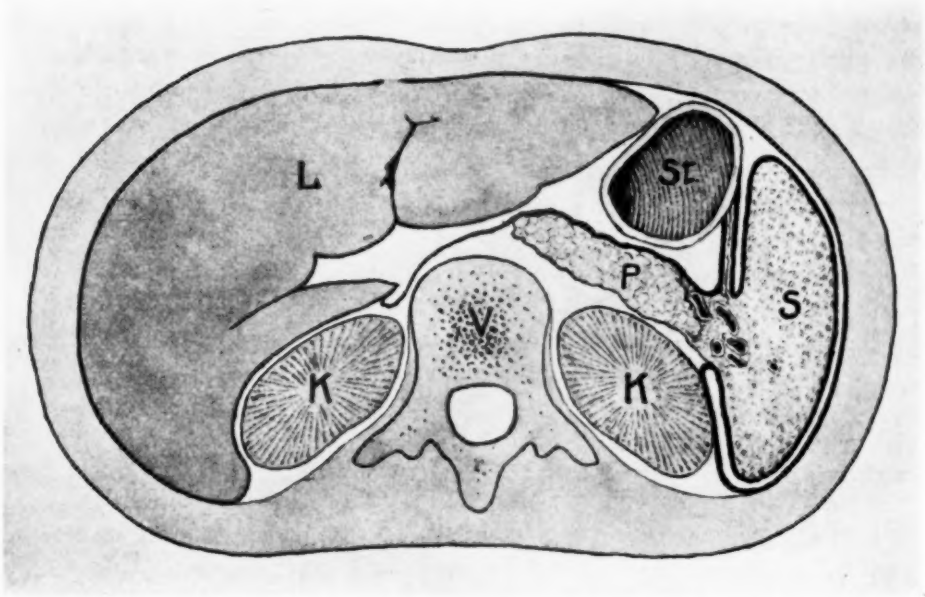


FIG. 3. Transverse section to show deep-seated position of the splenic pedicle and the necessity for division of outer leaf of the lienorenal ligament.

splenic vessels (Fig. 3). The outer leaf of this ligament is short and in splenomegaly is often thickened. It forms an effective barrier to delivery of the spleen into the wound and it must be divided as a definite step in the operation before any attempt is made to deal with the splenic pedicle. In order to expose the front of this pedicle the gastrosplenic omentum must be divided, the vasa brevia being ligated, and, that ready access to the pedicle in case of mishap may be ensured, this should be the first step of the operation (Fig. 4). The gastrosplenic omentum is very short at the upper pole of the spleen and care must here be exercised in ligating. It is of advantage to leave this short uppermost portion till a later stage in the operation when complete mobility of the spleen has been secured. That the stomach may not impede the view of the

splenic pedicle it is a good practice to pass a stomach tube and leave it *in situ* during the early stages of the operation.

Now comes the most important step in the operation. A

FIG. 4. Transfixion and ligature of gastrosplenic omentum.

hand is placed over the phrenic surface of the spleen and the organ is gently pulled over to the right. At the same time the left costal margin is retracted and the outer leaf of the lieno-renal ligament, which has been rendered tense, is exposed. With a long-handled knife the peritoneum of the ligament is divided and the spleen comes forward (Fig. 5). With a second

touch of the knife the thickened subperitoneal areolar tissue or fascia propria is divided and the spleen completely mobilized (Fig. 6). No difficulty is now encountered in delivering the

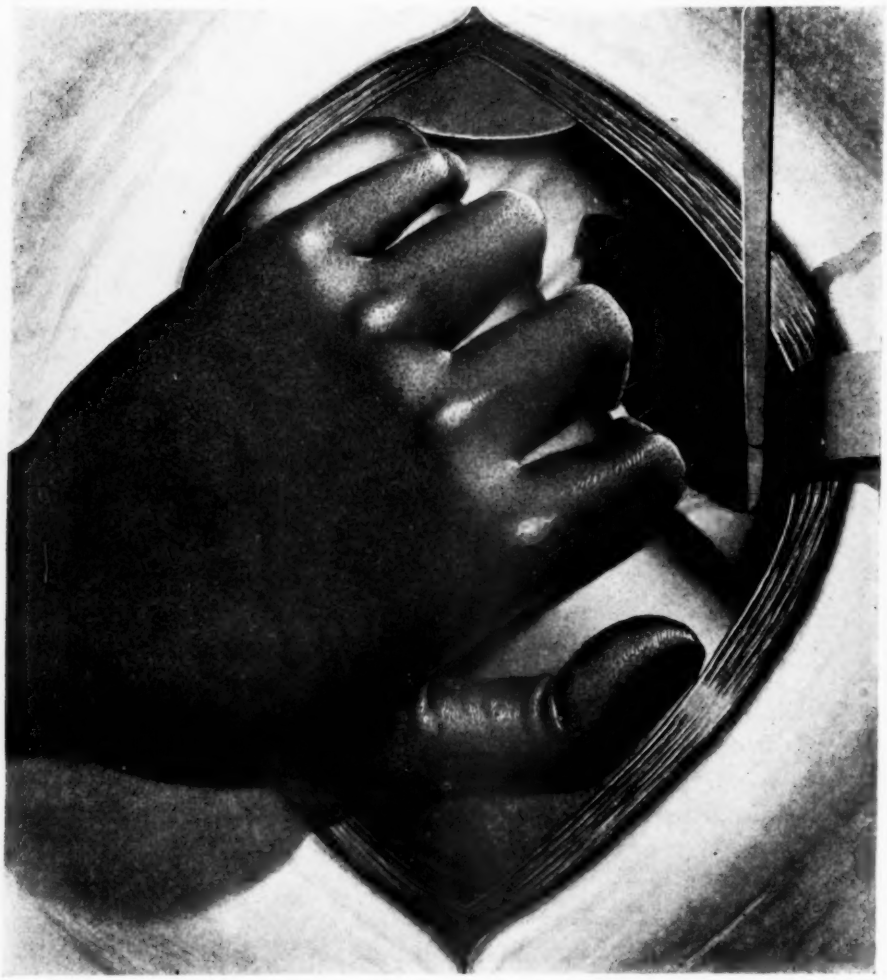

FIG. 5. Division of peritoneum of outer leaf of lienorenal ligament.

spleen in the abdominal wound. The upper end of the gastrosplenic omentum is now readily accessible and the very short vessels running from the stomach to the upper part of the splenic hilum are ligated and divided (Fig. 7). The main splenic pedicle is now raised on two fingers of the left hand. The

splenic artery which lies uppermost is freed, doubly ligated and divided. After a pause to allow of venous drainage and thus minimize loss of blood, the splenic vein is similarly dealt with

FIG. 6. Division of fascia propria of lienorenal ligament.

(Fig. 8). The tail of the pancreas can now be dissected off and the spleen removed. There should be no hemorrhage.

Summarized the steps of the operation are as follows:

1. Anesthesia.
2. Passage of stomach tube.

3. Left paramedian incision.
4. Ligation and division of the gastrosplenic omentum.
5. Spleen gently pulled to right and with a long knife the

FIG. 7. Division of gastrosplenic omentum almost complete. Note close contiguity of stomach to upper pole of spleen and the free exposure of splenic pedicle.

peritoneum forming the outer leaf of the lienorenal ligament divided. The underlying fascia propria is also divided.

6. Spleen delivered in wound and extreme upper end of gastrosplenic omentum divided between ligatures.
7. Pedicle raised on fingers.
8. Splenic artery doubly ligated and divided.

9. Splenic vein doubly ligated and divided.
10. Tail of pancreas dissected off.

There is no abdominal operation in which a deliberate

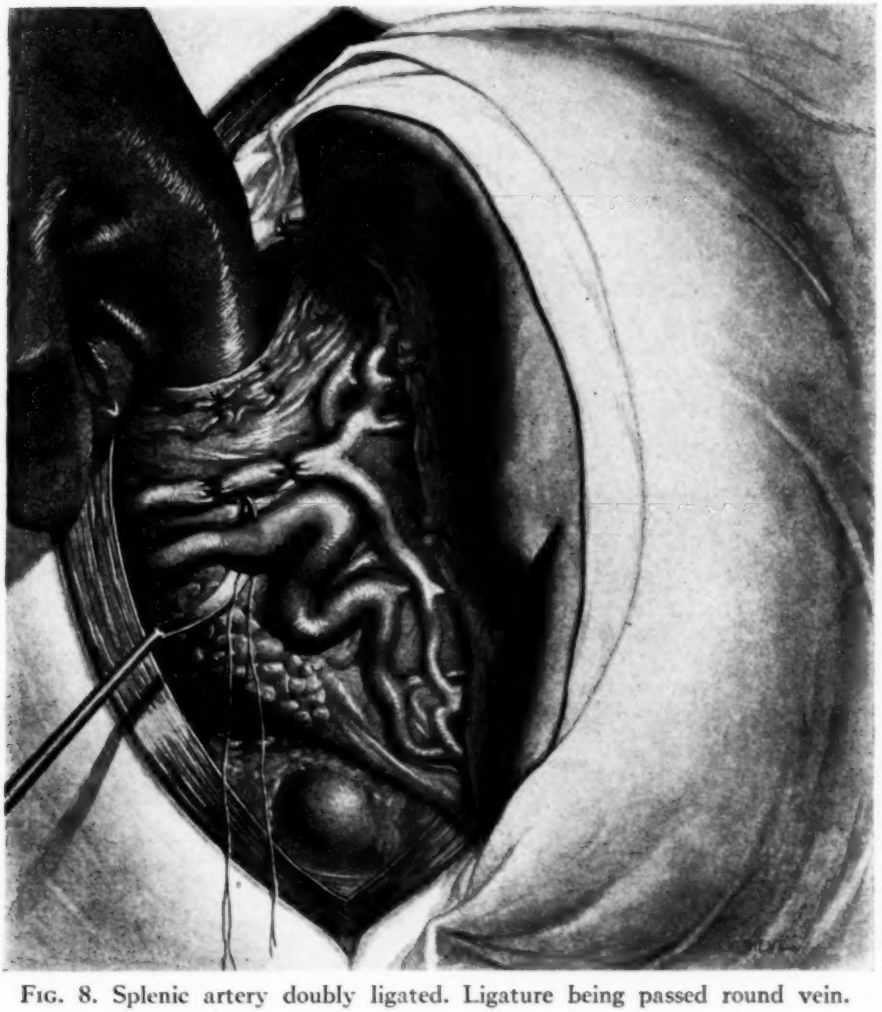

FIG. 8. Splenic artery doubly ligated. Ligature being passed round vein.

plan, based on anatomical knowledge, is more essential than in splenectomy. In dealing even with the largest spleen hemorrhage need not occur if such a plan be followed, and what some have called adhesions are, I believe, merely anatomical attachments thickened to support the weight of the enlarged organ. Speed is of no importance in the bad risk splenectomy; infinite care of preclude the possibility of hemorrhage is all-important.

# OPERATIVE TREATMENT OF PHTHISIS

## THE SURGEON'S MORAL OBLIGATION

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MANY years of clinical and laboratory observation have resulted in the general opinion that pulmonary tuberculosis[1] has a tendency toward recession and even toward permanent inactivity, provided the affected organ is placed at rest. This disposition to what we will call clinical cure is present in all stages of the disease but it varies in force with the degree of immunity which is encountered and this is never exactly the same in two individuals. Mixed infections and other complicating conditions, whether or not produced by the tuberculous process, will stand in the way of recovery, while the progress of a coincident fatal disease may terminate life before it would have been ended by the tuberculosis.

It is hardly necessary here to define the meaning of rest as employed in this discussion. Obviously it signifies not only absence of visible motion, but also as near an approach as possible to cessation of function. Rest of this type need not be permanent, however, and more or less function may be permitted to be reestablished according to the length of the rest period and the ability of the lung to behave normally.

The actual cure takes place by cicatrization with the obliteration of the spaces produced by destruction of tissue. There can be no absolute rest so long as pathological cavities exist in the lung. Complete drainage of these cavities is a necessary part of the rest in its fullest sense, whether produced by adhesion of their walls or by inspissation of their contents with calcification.

[1] Chronic ulcerative tuberculosis, as usually encountered, is the type referred to in this paper, not acute miliary or acute pneumonic tuberculosis.

With these few words let us assume that the main principles of the desiderata in the surgical therapy of tuberculosis are understood by the reader and that the question is that of the selection of patients and the sequence of operative procedure. I have mentioned the patient first because one must have a patient before he can operate. But since in making any important decision one should look into whatever choice of action there may be, I will reverse the order and give a short review of the surgical procedures at our command. Finally I shall analyze the question which is hinted at in the title of this paper, namely, in what cases has the surgeon the right to withhold the chance offered by operation.

## METHODS OF SURGICAL ATTACK

1. Interruption of Phrenic Innervation. Yates, of Milwaukee,[1] has devised a means for temporarily reducing negative intrapleural pressure and for diminishing the size of the affected lung, by crushing the phrenic nerve through an incision in the neck.[2] The resulting diaphragmatic paralysis may be expected to persist for three months or more during which the patient is treated on hygienic principles and also by repeated small blood transfusions; for it is Yates' opinion that hyperemia is of value in combatting a tuberculous lesion. This method of treatment has its best application in early cases before fibrosis and cavitation have begun. The elevation of the diaphragm produced by the negative intrapleural tension and by the pressure of the abdominal viscera from below, takes away from the pleural cavity the equivalent of from 200 to 500 c.c. or more of air.

2. Artificial Pneumothorax. The technical details of this method will not be described here. Its object is to increase the size of the pleural space and at first to collapse and eventually compress the affected lung, giving it more or less complete rest from both visible expansion and respiratory function.

[1] Yates, J. L. *Arch. Surg.*, 19: 1122–1160, 1929.

[2] Operation upon the phrenic nerve to reduce intrapleural negative tension is not new. (Stuertz. *Deutsche med. Wchnschr.*, p. 2224, 1911.)

Small quantities of air are insufflated as a tentative measure and so-called low tension pneumothorax is produced. The less diseased or the healthy parts of the lung may then function while the infiltrated portion remains immobile. This is called the selective action of low tension pneumothorax but in reality, of course, it is not a selective action, for the diseased part of the lung is not truly compressed.

In most cases in which treatment by pneumothorax is applied cavitation with fibrosis is present, whether the case is one of months or of years in duration. In certain cavities with collapsible walls a complete obliteration may be produced and when, after months or a year or more the lung is again permitted to expand, the cavity will have been replaced by scar tissue and a true arrest of the tuberculous process may have occurred. Treatment by pneumothorax is less applicable when there is solidification of the lung but even here it may be of some value.

The liability to hemoptysis is greatly reduced by intrapleural pneumatic compression and even active hemorrhage may promptly cease.

The principal difficulty in producing pneumothorax, one which often prevents the use of this agent, is adhesion between lung and parietal pleura. If these adhesions are soft gradual increase in air tension may break them down; or certain string-like connections between lung and chest wall may be divided according to a plan devised by Jacobaeus with the use of an instrument which is inserted into the chest cavity between the ribs and which permits visual exploration as well as the division of adhesions.

The dangers of therapeutic pneumothorax are, briefly, hemorrhage from the chest wall or from an accidental injury to a visceral vessel; cerebral air embolism if the patient is treated, wrongly, in the upright position; and the production of pyopneumothorax with mixed infection. If this form of pyopneumothorax cannot be controlled by evacuation and antiseptic washing through a needle or cannula, open drainage

may be necessary, but this frequently means that other operations for the obliteration of the infected pleural cavity must be performed.

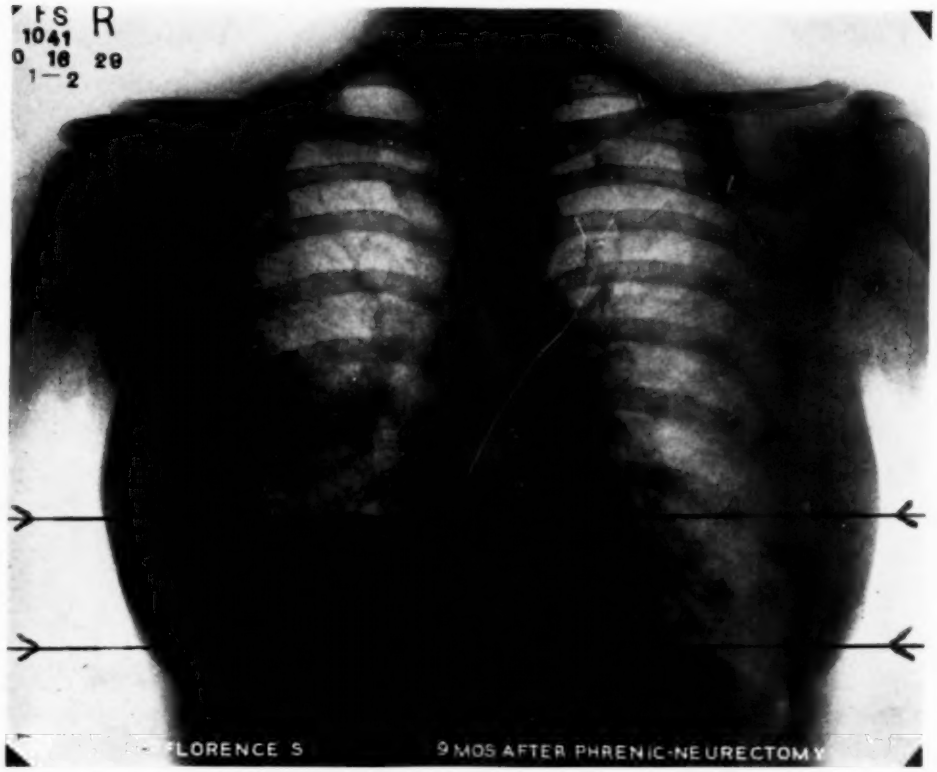


FIG. 1. Suppurative bronchiectasis. Showing elevation of right diaphragm nine months following phrenic neurectomy. Horizontal lines mark level of diaphragmatic domes. Compare with Figure 2.

In deciding upon the sequence of treatment between pneumothorax and phrenic nerve interruption it must be remembered that the latter procedure renders the diaphragmatic muscle flaccid and that therefore it should never precede artificial pneumothorax. The powerless diaphragm will be merely pushed down by the increasing air pressure within the chest. Observe Figure 1, not, by the way, a case of tuberculosis but one of suppurative bronchiectasis of the lower lobe. In this picture we see the result of a phrenic neurectomy which has elevated the right diaphragm and has partly compressed

the bronchiectasis. After this operation there was but little improvement and it was my intention to extirpate the pulmonary lobe but the patient refused and I referred her to Dr.

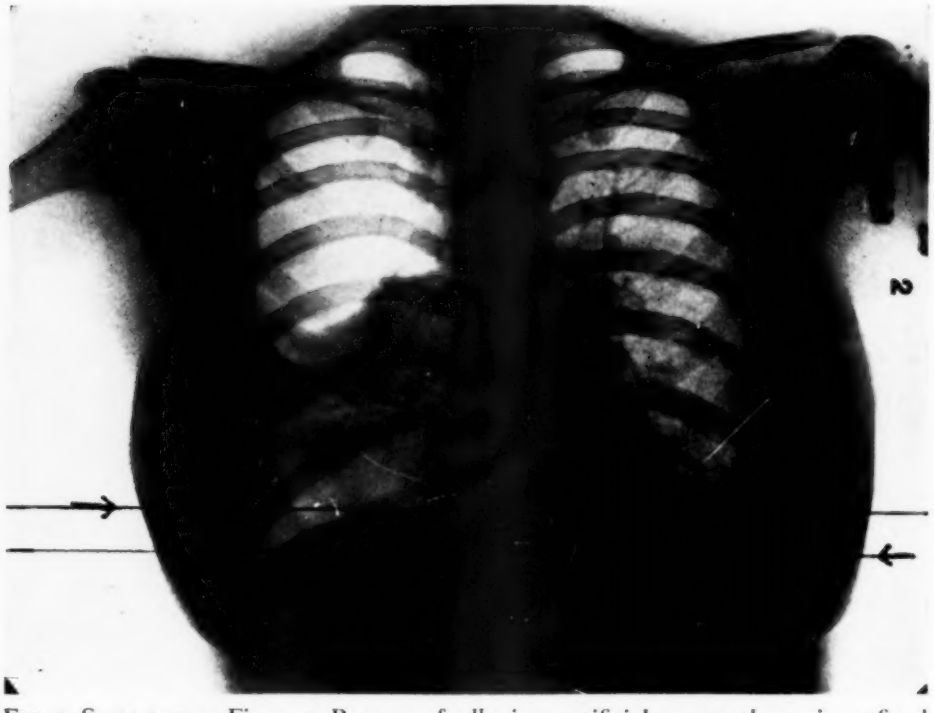

FIG. 2. Same case as Figure 1. Because of adhesions artificial pneumothorax is confined to the upper half of the chest. There is but slight collapse of the bronchiectatic lung and the flaccid diaphragm has been forced down to its preoperative or normal position. Horizontal lines mark level of diaphragmatic domes.

Harry Wessler for treatment by pneumothorax. Adhesions prevented the complete collapse of the lung and unfortunately only the upper healthy portion was compressed by air. At the same time it is interesting to note in Figure 2 that the diaphragm has been pushed down to the normal preoperative position.

3. THORACOPLASTY. *Paravertebral Thoracoplasty.* This operation is an improvement by Ferdinand Sauerbruch on the methods of others to bring about permanent compression of the lung with obliteration of pathological cavities.

More than one hundred years ago the idea of surgery as a treatment for tuberculosis was in the mind of Sir James Car-

son[1] but to Brauer belongs the credit for deliberately advising surgical collapse of the chest. This was in 1906. It was Sauerbruch, however, who reasoned that resection or the mere division of the ribs close to the spine would cause them to be drawn downward and inward; not only by the constant though slight suction within the chest but also by contraction of the muscles of the trunk. At present this operation has become the best known and, on the whole, the most successful one in all the surgery of phthisis, although often enough it may become merely the first of a series. If the compression is not as complete as would be necessary to obliterate the pulmonary air spaces whether pathological or normal, supplementary operations are required and these will be catalogued farther on.

Paravertebral thoracoplasty may be performed in one stage or in several, but if serial operation is the choice the first attack should be upon the upper part of the thoracic cage including the first rib and as many below it as seems wise according to the patient's general condition. The ribs below those divided at the first stage should be resected either in one or two more stages as soon as the patient has recovered from the immediate shock and depression of the first seance. If too much time is permitted to intervene between operations, union by callus of the ribs already divided may interfere with the degree of compression in the upper chest which we might have expected from the number and length of the bone sections which were taken. There is usually less shock and less danger, however, from the operation upon the first five or six ribs than from those below because the amplitude of respiratory motion is much greater in the lower half of the chest and putting this lower part out of commission causes far greater physiological disturbance than that which follows the upper operation. All these rib resections should be performed subperiosteally for, if the covering is removed along with the bone, union will either not take place at all or will be so deferred that persistent free mobility of the bony chest wall will prevent

[1] Essays, Physiological and Practical. F. B. Wright, Liverpool, 1822.

the very thing, namely, absolute rest, for which we have been striving.

Under no circumstances should an encircling dressing of any kind be applied, not even a single bandage or strip of adhesive plaster. All postoperative compression should be secured by some form of elastic material, taking its support not far across the midline, front and back. I have found the elastic adhesive plaster known as Elastikon to be of great value in the dressings following thoracoplasty. But even with this excellent material there may be dislocation of the mediastinal structures, including the heart, toward the opposite side with consequent respiratory and circulatory embarrassment. Cyanosis is the signal for the immediate reduction of compression over the side which was operated upon.

The presence of large cavities with free bronchial connection in the upper chest counteracts normal negative pressure and when the patient coughs after the operation such cavities are ballooned out by the pneumatic impulse from the opposite lung, thus contributing to the maintenance of the hollow instead of permitting it to collapse. The surgeon, as well as the physician or phthisiologist, should bear this in mind so that the deficient collapse may not be wrongly attributed to a fault in the operation. However, an immediate incomplete effect of this kind, while it may eventually necessitate further surgical procedure, need not be regarded as the ultimate result of the thoracoplasty since these cavities may gradually contract over several months or even a year and the mediastinum, deviating toward the more diseased side, and the physiological emphysema of the opposite lung may further aid in obliterating the cavity.

The tuberculous patient, even though he may be seriously ill, with high fever and with comparatively low blood pressure, will usually endure operative procedures astonishingly well and this fact is seldom recognized by the physician in charge. To be sure there is a sharp reaction for a few days, probably because of the absorption of toxins resembling, in a measure,

the disturbance following an injection of tuberculin. After this, however, convalescence may be expected to proceed normally. The mortality rate in my own experience appears to

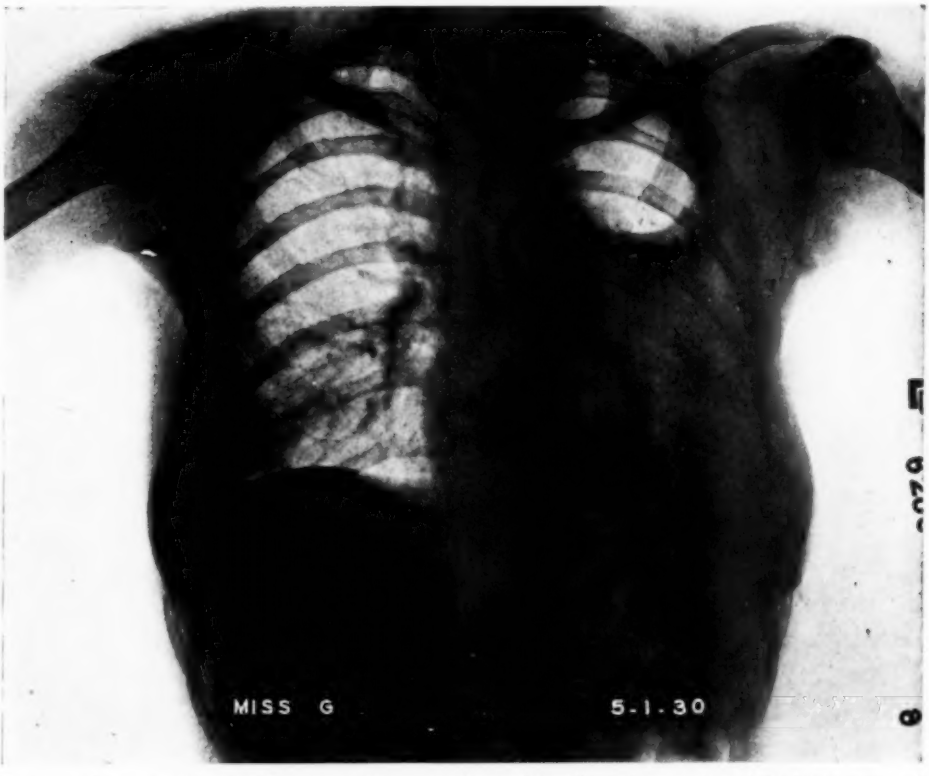


FIG. 3. Case VI. Large left upper lung cavity with pleural sacculated fluid level and pneumonic lower part of the lung. Right lung nearly normal.

depend largely upon what happens to the contralateral lung, for we have here in addition to the usual dangers following any thoracic operation, the added peril of the lighting-up of an old process. Because of this it is best to withhold operation until clinical and *x*-ray examination for at least two consecutive months have shown a static contralateral condition. (See Case VI, Figs. 3 and 4.)

If patients are carefully selected for surgery with regard only to statistics the death rate will doubtless be lower than would be the case if the weeding-out process had been given

less attention; but we shall miss the chance of restoring to health and usefulness many a one who would otherwise die an early death or whose only hope would be to linger on for a

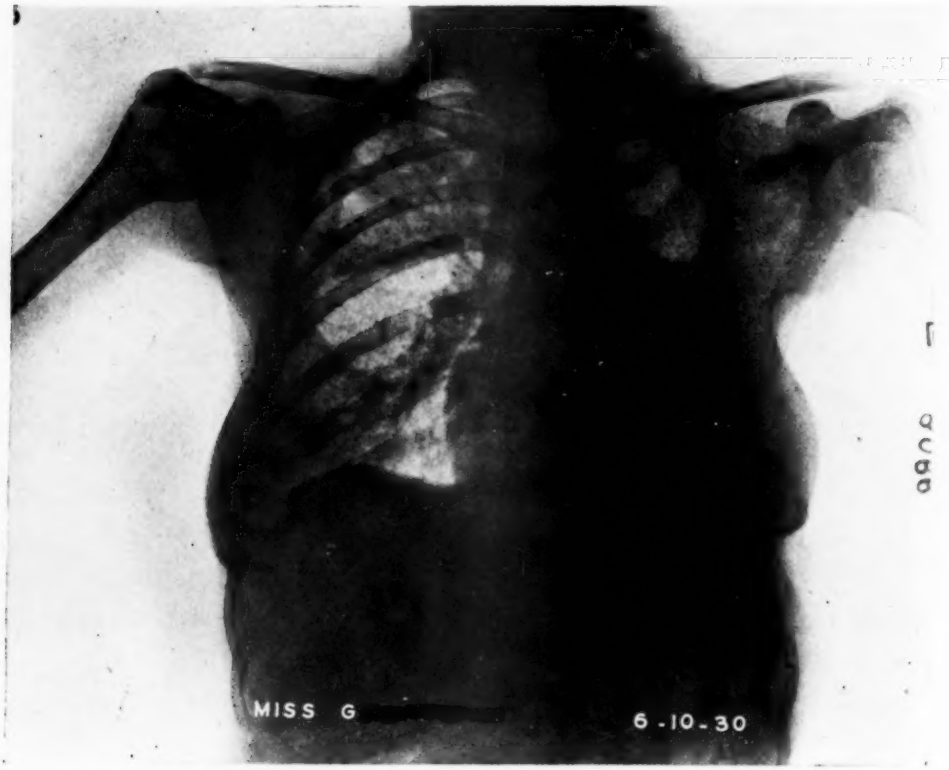


FIG. 4. Case VI after second (lower) stage of thoracoplasty. Fatal pneumonic extension to opposite lung.

space, a misery to himself and to those who love him. In the concluding part of the paper this phase will be taken up in greater detail.

*Secondary Thoracoplasty.* Should it be found, after the postoperative state has become well established, that compression is still inadequate, further rib resection, either through the old scar or along the axillary line or even on the front of the chest may be required in order to bring about further obliteration of the lung space. These operations are rarely as dangerous as that which the patient has already experienced. At all

costs if the disease is to be arrested good compression must be secured.

4. Apical Extrapleural Compression. When all seems to be well except for insufficient collapse of the thoracic dome a further procedure known as *apicolysis* or *superior extrapleural pneumonolysis* may be carried out. This consists in the subperiosteal resection of two or more of the upper ribs reached through an axillary incision with peeling away of the soft parts from the bones including, of course, the endothoracic fascia and pleura, from behind forward and from above downward so that the apex of the lung is finally replaced by a large extrapleural artificial space. This should be maintained in one way or another by some form of daily packing, and the chances are excellent that it will become permanently and rigidly obliterated, the skin dipping down to the bottom. Not until this has occurred can one be assured by the improvement in cough and expectoration that our goal has been reached. Even then, however, cavities, bronchiectatic or other, in the lower lobe of the lung may contribute to a continuance of the symptoms.

Apicolysis, though a delicate operation, is not a particularly dangerous one if I may judge from my own results, for I have not lost any tuberculous patient from this cause,* and have only lost one other case, that of an individual with acute abscess of the right upper lobe.

5. Direct Drainage and (6) Myoplastic Plugging. Occasionally a tuberculous cavity becomes the seat of mixed infection, sometimes anaerobic in character. There is then a tendency to gangrene of lung tissue with consequent severe hemorrhage combined with a peculiar sepsis which this infection produces. It may then be necessary to perform actual drainage into the world as in acute progressive lung abscess. This will give quick relief but although thoracic fistulae of this type contract and may even close spontaneously,[1] yet

* Since this paper was sent for publication—about a year and a half ago—I have lost a patient following apicolysis. (H. L. Aug. 20, 1931.)

[1] Lilienthal, H. *Arch. Surg.*, 19: 1161–1168, 1929.

the tuberculous cavity itself remains patent. Applying the ingenious and original method of Pool and Garlock[1] a large pedicled flap of muscle, preferably from the paraspinal group, may be turned into the cavity with a reasonable chance that the plugging will be permanent. Pool and Garlock devised this procedure for non-tuberculous abscesses and I have completed the operation in only one case of tuberculosis. The result, so far as the obliteration of the cavity was concerned, was perfect; the patient, however, is suffering from tuberculous disease of other parts of the lung more than year after the myoplastic plugging.

It appears that muscle is not particularly susceptible to infection by Koch's bacillus.

In another case the incision for the original thoracoplasty had been made so close to the spine that these muscles could not be used and I employed the upper two-thirds of the latissimus dorsi which, however, was not of sufficient bulk to fill the great space in the lung, so the operation could not be completed. The result was only partially successful. The idea of Pool and Garlock is excellent and I am convinced that further experience with this procedure will make one less fearful of thoracoctomy in the direct drainage of tuberculous cavities.

The operations which have been here listed and briefly described are intended to place the lung in such a condition that the natural recession of the pathological process may be unimpeded.[2]

7. PNEUMONECTOMY. For an absolute and not merely a clinical cure, it would be necessary to extirpate the diseased lung and this was actually carried out many years ago by Sir William Macewen. His success in some of these cases is a great tribute to the vision, skill and resourcefulness of this eminent man who, long before the standardization of thoracic surgery, was able to achieve such an amazing result. His

[1] Pool. E. H., and Garlock, J. H. *Ann. Surg.*, 90: 213–237, 1929.

[2] Very seldom progressive tuberculosis has been found in a surgically collapsed lung.

example, however, has not been followed and with the recognition that tuberculosis is, probably from the beginning, a general infection, the eradication of the disease by removing its principal seat is hardly possible.

### EMPYEMA

The complication of tuberculosis by mixed empyema is one which changes the entire aspect of the case as well as the plan of action. The accident may happen from the infection of the fluid so commonly seen during treatment by artificial pneumothorax or it may be brought about by the infection of a tuberculous pleural effusion. Rupture of a pulmonary cavity or its ulceration into the pleural space is the commonest cause of spontaneous pyopneumothorax and there is then always a pleurobronchial fistula although it may be of small size. Gas may, however, be generated by certain of the infecting bacteria without bronchial connection. At any rate, the addition of empyema to tuberculosis is a serious thing and brings with it the difficult problem of obliterating the pleural space with as little expansion of the lung as possible, at the same time permanently closing the fistulae both bronchopleural and external. Tension within a closed pneumothorax of this type usually results from a valve-like action of the bronchopleural opening which permits air to enter the pleura but blocks its exit through the natural passages. This extremely dangerous condition becomes a veritable emergency and must be treated by some form of thoracotomy or paracentesis so that the hypertension is greatly reduced or is made to disappear. The fluid in an empyema not accompanied by tense pneumothorax should be examined microscopically and by culture to identify the pathogenic organisms, for in many instances contaminating bacteria may be eliminated, as stated before, by washing and disinfection through a needle without an incision into the pleura (Figs. 5 to 8). When accompanied by tense pneumothorax, however, aspiration affords only temporary relief and thoracoctomy must be performed, with or without rib resec-

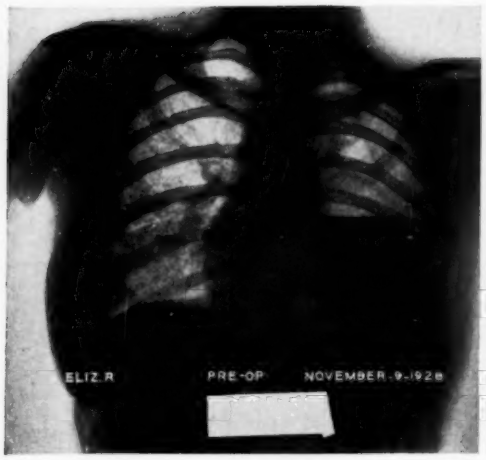

FIG. 5. FIG. 6.

FIG. 5. Elizabeth R. Phthisis. Pyopneumothorax. Culture from fluid yielded pneumococcus type 3. (From *Ann. Surg.*)

FIG. 6. Same case as Figure 5, but after thoracoplasty. Fluid absorbed following repeated aspiration and disinfection. No thoracotomy. The air and fluid present at the time of thoracoplasty prevented full collapse. (From *Ann. Surg.*)

FIG. 7. FIG. 8.

FIGS. 7 and 8. Photographs of Elizabeth R. After healing. (From *Ann. Surg.*)

tion. In most of these cases it will be found that the empyema has effectively compressed the lung and if, for the reasons just given, open drainage is unavoidable the procedure should be planned so as to maintain this pulmonary collapse. Almost invariably there is great difficulty in bringing about the healing of the bronchial fistula, and while it is most desirable that these openings should be closed yet life may go on in comparative safety and comfort even with a permanent bronchial stoma through a thoracic fistula (See Case IX).

Reduction in the size of the infected pleural space may be gained by various forms of thoracoplasty. The patient may now have the deciding vote on the question of further operation to close the chest after the risks and advantages have been fully explained to him. The persuasion of the surgeon, which would be justifiable in the consideration of procedures looking toward the arrest of the tuberculosis, is not called for here.

## ABOUT STATISTICS

To deny the value and importance of statistical study would be absurd. In business and in finance it is necessary, and in pure science it is essential. The great tables of the Life Insurance Companies have established an enormous mass of detailed facts which are of benefit both to the companies themselves and to the public. In a more remote way they exert an influence for good upon us all, prolonging life and minimizing the incidence of illness. But medicine, including surgery, is far from being a science. In spite of all our endeavor to make it so we find that after all it is the head and the hand of the doctor himself which determine the fate of the patient, regardless of mathematics.

Viewing medicine from its scientific angle there can be no objection to the publication of tabulated records, whether individual or collected; but, however valuable such records may be in the abstract, their importance regarding the single case in hand should not be overestimated. In calculating the

results of treatment in such a disease as tuberculosis of the lungs we come upon the inescapable separate nature of every case and of every patient. In arriving at a decision of importance, such as whether or not to operate, we must deal with the person before us; and no one better than the patient himself will appreciate this. Therefore, while it is good to have a knowledge of mathematical probabilities, the surgeon who has this too strongly fixed in his mind will lose the perspective of his own experience. Before he operates upon his first tuberculosis patient he should have had the opportunity of observing the work of others and of assisting at the wound often enough to have familiarized himself with the technique. As his own experience grows he will form impressions and he will be in a position to decide individual questions on their merits. No patient is interested in statistics of mortality unless he thinks that he himself will not be among the missing. It is sufficient that his phthisiologist assures him that so far as medical help alone goes, cure is not possible, but that with the aid of successful surgery conditions for further treatment will be improved. He must, however, return to the sanatorium or to the care of his physician when the wound is healed.

There are variations in the conditions surrounding the operation so that the only fair thing to do is to advise for or against after a most conscientious review of the progress of the illness from its beginning. The final question arises as to the ethics of submitting a person to an ordeal which may, on the one hand, shorten his life or which, if successful, may cure him. I maintain that the only thing which must, at all costs, be avoided is a procedure which might leave the patient in a state more intolerable than before.

For those who have recovered, even though they may represent but a small percentage, life has begun all over again. The families of those who died should feel a sense of relief instead of sorrow, that the intolerable and hopeless misery is at an end. Only the surgeon who lays too great stress on statistics will perhaps disapprove.

## RESULTS FOLLOWING OPERATION

A patient may be cured, improved, unimproved, worse, or dead. And at once we run upon that dreaded word in all statistics, *Definition*.

What is meant by cure? Even the so-called clinical cure, after recovery from the operative treatment of tuberculosis? This is indeed difficult to answer. For example, a reporter may regard as successful any result in which the patient is alive after a specified period, let us say three months, six months, one year. But it is obvious that a "permanent cure" of tuberculosis is in the same category with the definition of a "happy" individual by Solon, the Greek philosopher, and that not until the patient is dead can one be sure that the old enemy will never again rise up against him. Therefore, when surgery has accomplished an arrest of the active disease so that the patient feels that he is well, there should still be no relaxation of care and watchfulness throughout his entire remaining life. And this brings us to the discussion of what is meant by success in the surgical treatment of phthisis.

The absurdity of accurate conclusions from statistics in pulmonary phthisis may be easily demonstrated by two hypothetical cases. Let us say that a certain reporter has chosen six months as his statistical period and that any patient living at the end of that time will be counted as exemplifying a successful case—not to say a cure. Now, he has operated upon John Doe and John has progressed satisfactorily throughout the half year's period following the last procedure. He has gained in weight; his cough and expectoration have left him; his temperature is normal. On the day following the six months' period he dies of hemoptysis! . . . Next comes the case of Richard Roe who steadily deteriorates, not because of his operations, let us say, but in spite of them. His phthisis continues to advance, uninfluenced by the treatment and at the end of six months he is still alive, though sinking. According to the strict reading of statistics both cases should go on the

list of operative cures, though their progress was quite different and neither operation was successful. It all depends, in the last analysis, upon the surgeon's individual manner of estimating his results.

Figuring out the possibilities of success or failure from the charts of others is useful in proportion to the degree of one's intimate acquaintance with the reporter, and the knowledge of his methods of compilation. It will confuse the issue if we eliminate from the mortality list certain cases in which death cannot be proved to have been the outcome of the surgical procedure *alone*, unless the details in every case are analyzed; clearly a task which could only be accomplished with the aid of the surgeon submitting the table, and even then with the chance of error because of differences of interpretation.

Let us assume that soon after a thoracic operation upon a tuberculous patient a fatal hemorrhage closes the scene. Who can say, even after the post-mortem examination, whether the bleeding was produced by the operation or whether it was a terminating accident of the disease? And with other mishaps the same—a perforation with tense pneumothorax; cerebral embolism; sudden cardiac failure, etc. Those surgeons who lean over backward and regard all postoperative deaths *in the hospital* as the result of operation, are equally inaccurate but their statistics are of real value in comparing one of their own periods of time or one of their numerical group-units with another. I am speaking here particularly of pulmonary phthisis and not of other conditions.

In the April 1930 number of *Western Medicine*, published in San Francisco, there is a paper by H. E. Schiffbauer which is well worth reading and digesting. The title is Indication for Surgery in Pulmonary Tuberculosis. For the very reason that I believe this to be an important contribution and that it will have a wide influence I wish to differ here with the author in what seems to me to be a vital point. Schiffbauer says that: "Results from operation on improperly selected cases will be unfavorable and a discredit to surgery." Among his contra-

indications I will mention but three. The first is the question of "resistance to surgery." Now this is something which it is impossible to know until the test is made. Among medical men and even among phthisiologists there is a general feeling that their patients are particularly ill-suited to withstand an operation. In reply, I will say that from a considerable and long practice in general surgery and in its thoracic branch the tuberculous patient is fully as good a subject as the average non-tuberculous one of about the same degree of illness, as measured by nutrition, blood picture, abnormalities of temperature and cardiovascular sufficiency. I agree with Dr. Schiffbauer that myocardial degeneration should contraindicate any surgery except that of dire emergency. But "kidney impairment," unless it be a progressive nephritis, may disappear with the clinical cure of the pulmonary trouble. (See Case III.)

"Discredit to surgery" is the main point on which I take issue in the hope that I may allay in a measure the fear of a high mortality rate among patients who have been regarded by careful observers of wide experience as doomed.

I will admit that there are some conditions either of the tuberculous disease itself or of coexistent pathological processes which definitely forbid a resort to radical surgery and instead of making a detailed list of these, I will present here a table of broad scope leaving the finer differences to be determined by the reader.

*The Tuberculous Infection*

1. The contralateral lung so far destroyed that without its fellow it cannot be expected to exert a life-supporting function.
2. Other essential organs of the body broken down beyond repair.
3. Progressive cerebral lesions.

Tuberculous lesions affecting the larynx, the kidneys, the intestinal tract or other organs should not prevent the employment of operative surgery in the effort to clear the pulmonary

condition. Often the successful accomplishment of this result will improve resistance and may promote general convalescence.

*Disease Other than Tuberculosis*

1. Advancing cardiovascular disease.
2. Progressive nephritis.
3. Other essential organs destroyed beyond repair.
4. Malignant neoplasms not safely operable.

On the other hand, disorders of metabolism, such as diabetes, do not *per se* prohibit operative treatment and in other complicating so-called general disease the question will require individual decision.

Manifestly, if contraindications can be eliminated the question of operation, at first refused, may be reconsidered.

## CASE HISTORIES

There can be no better way to indicate my attitude in this most important question than by submitting clinical examples. Let me select, then, from the entire list of my patients, ten who appeared to be almost or even quite beyond hope and who seemed to have but a few days, weeks or, at the most, months to live. In none of these cases did I urge or even suggest operation, but in none did I refuse, except in that of Case III in which I at first refused, then, some weeks later, when the patient's plight was even worse, finally consented; and complete arrest was the reward.

The histories, presented in brief résumé follow:

CASE I. *Progressive lesions with serious complications.*

Mr. F. G., aged thirty-one, had right sided upper pulmonary fibrocavernous tuberculosis, his illness having lasted for at least three years. There were physical signs in the opposite lung as well, but *x*-ray examination revealed nothing of grave import on that side. When I first saw him he was expectorating 16 oz. of mucopus. He had a tuberculous laryngitis; albumin and casts in the urine; frequent hemoptyses and a diarrhea clearly indicating intestinal lesions. It looked as if he could not live more than one or two months.

In 1924 I avulsed his right phrenic nerve and then performed a thoracoplasty of the first six ribs. There was improvement but the expectoration continued and two years later I did a right apicolysis after which he made a really beautiful recovery and was discharged from Loomis Sanatorium as an apparently arrested case, although there was slight non-bacillary sputum. Kidneys, intestines and larynx well.

This case exemplifies a type which might, on very good grounds, have been refused operation. Dr. J. Burns Amberson, who had referred him to me, rightly believed that there was nothing to be lost by operation and nothing to be gained by any other form of treatment. Unfortunately there are too many physicians and some surgeons who would have taken the opposite stand.

CASE II. *Massive hemorrhages. Tuberculous diarrhea, etc.*

Mrs. E. F., aged twenty-nine, had been ill for more than two years. There was a large right-sided cavity extending from the apex to the fourth interspace and there were many smaller ones below. The opposite lung was not appreciably diseased. The patient had laryngitis, tuberculous otitis media, diarrhea and severe hemoptyses. There were also albumin and casts in the urine. She was operated upon in 1924 and died a little less than a year later of nephritis with great edema and tuberculous enteritis.

CASE III. *Bilateral tuberculosis with multiple and grave complications.*

Mr. H. F. H., aged thirty-five, had been ill for many years. The principal lesion was a large apical cavity. The opposite lung was considerably diseased but for a few months the lesions had not progressed. There were double tuberculous otitis media, enteritis, nephrosis with great edema of the legs and cicatrized laryngeal tuberculosis. The outlook was so bad that at first I believed the case to be inoperable. Some months later, in Dec. 1928, Dr. Amberson urged me to give this man such benefit as might be remotely possible with surgery and I operated. His family were emphatically told that the prognosis was extremely bad. After thoracoplasty improvement began and Mr. H. was discharged in less than two years, clinically well, an arrested case. His nephrosis had disappeared. There was no fever. The slight morning expectoration was persistently free from bacilli. He went back into the world under normal living conditions.[1]

CASE IV. *Hemoptysis the urgent reason for operation.*

Mr. J. M. E., aged twenty-eight had been ill for four years with general left fibrocavernous changes and with comparatively little disease in the

[1] As stated before, all these patients are expected to be ever watchful.

right lung. In March 1926 there came a series of rapidly recurring hemorrhages which appeared to be immediately threatening to life. He entered the hospital directly from the ambulance and was operated upon by thoracoplasty as the most certain method of securing prompt collapse. As in all my other patients pneumothorax had been unsuccessfully tested. The hemorrhage at once ceased and great improvement followed. The patient, however, "is still taking the cure."

CASE V. *Fibrocavernous tuberculosis with complicating hyperthyroidism.*

Mr. J. B., aged thirty-three, had bilateral tuberculosis with a quiescent lesion on the right side, infraclavicular, and with extensive fibrocavernous disease on the left. He had been operated upon some years before for exophthalmic goiter and his pulse was still rapid; there was tremor and also slight exophthalmos. X-ray pictures (Dr. William Snow) revealed the presence of a large cavity and several small ones in the upper left chest, with general fibrosis. On the right side there were scattered conglomerate infraclavicular tubercles. The reading was later confirmed at another *x*-ray examination by Dr. Leopold Jaches. I was assured by the phthisiologist in the case, however, that the right lung had not changed for more than two months. Thoracoplasty was done in January 1930 in two stages with much improvement both in cough and in the quantity of expectoration (still, however, bacillary) and, to my great gratification, in the disappearance of the tremor and abnormality of the pulse. This patient is now taking moderate exercise and is, I believe, convalescing although, if the expectoration does not disappear and the main cavity is not obliterated, an apicolysis may be necessary.

CASE VI. *Extensive left fibrocavernous disease with tense pneumothorax and dyspnea.*

Miss E. G., aged twenty-five, had been ill for eight years. The right lung, according to physical signs and *x*-ray examination appeared healthy. On the left there was extensive destruction and suddenly there appeared dyspnea and high fever. She was then referred to me by Dr. Joseph R. Morrow of Bergen Pines Sanatorium and I operated as in an emergency, resecting one rib and entering the pleural cavity. There was sacculated air under pressure but very little fluid and the lung felt solid to the touch. This was in April 1930. I waited for nearly two weeks for improvement to occur but the patient was rapidly losing ground and still dyspneic with respirations as high as 48. I then performed an upper stage thoracoplasty, six ribs, with great immediate improvement. Ten days later the five lower ribs were resected but soon afterward the opposite lung became acutely and extensively infected and the patient died. (Figs. 3 and 4.) I do not know how this could have been avoided. Because of the quantity of

sputum most of the operation was done with local anesthesia. Only a few whiffs of nitrous oxide were given for analgesia, which did not abolish the cough reflex. Figure 4 shows what happened. As I have stated before

FIG. 9. Case VIII. See text. Partial outline of empyema cavity after several operations. (Lipiodol.) (From *Ann. Surg.*)

this is one of the most frequent fatal complications following any operation in the treatment of phthisis.

CASE VII. *Left fibrocavernous disease with pyopneumothorax, not tense.* Dr. L. M., aged forty, had been ill for more than one and one-half years. He was sent to me almost in extremis; the temperature 104°F.; two recent attacks of cardiac irregularity; tuberculous enteritis. General condition extremely bad. At the earnest request of the patient's family, I began what was to have been a series of operations, by avulsing the left phrenic nerve; then evacuating fetid gas by trocar and cannula. The patient was delirious and in desperate straits. I hoped to tide over the acute stage by emptying the chest and that phrenic interruption would lessen the septic absorption. The man died in spite of all that was done, not because of it. His case is mentioned here merely to show that I have not refused even the slightest chance to improve an apparently hopeless case.

CASE VIII. *Illustrating tuberculous empyema with septic mixed infection.* Mr. A. L., aged twenty-four, had been ill for two years and the lesions were principally in the right chest. There was spontaneous pneumothorax. When I saw him in February 1926 he might have been called moribund

with little, exaggeration. The temperature was 104°F., respirations 38 and labored. His condition was so poor that his uncle, an experienced physician, advised against any operation fearing that he would not survive

FIG. 10. Case VIII. Photograph after complete recovery. A strip of elastikon is worn for comfort because of motion, still present, in lower ribs. It has since been discarded and the chest wall has become rigid. (From *Ann. Surg.*)

even a minor thoracotomy. For this very reason, that he was hopeless without a surgical miracle, I advised intervention and made a tiny drainage opening. Later it was enlarged and eventually several operations for the obliteration of the pleural cavity were done with final complete restoration to health. The patient recovered and leads a life of normal activity in business. (Figs. 9 and 10.)

CASE IX. *Sudden acute perforation of pulmonary cavity. Pyopneumothorax.*

Dr. S. V., aged forty-five, had been ill for nine years with bilateral tuberculosis which had become arrested on the right side while on the left there was an uncollapsible large apical cavity. Mixed infection with perforation occurred in February 1926. There was a large bronchopleural fistula and the patient was constantly coughing and expectorating. A phthisiologist of international reputation had strongly urged against operation of any kind. Dr. Golembe of Liberty, New York, however, a man of broad vision, felt that life could go on but a short time as things were and referred the patient to me. Thoracotomy gave relief at once,

and thoracoplasty reduced the size of the infected pleural space. The bronchial fistula, however, did not close and the patient feeling that he is able to lead an almost normal life, in spite of the slightly discharging fistula, refuses further procedures.

CASE X. *Bilateral disease, right stationary. Left pyopneumothorax with sepsis; bronchial fistula.*

Mrs. G. W., aged thirty, had had a rapidly progressing tuberculosis for a year with fibrocavernous condition on the left side, the right having become stationary in a fibrosing condition with no cavities. On the left there were empyema and a bronchopleural fistula. When I first saw her she had fever, continuous cough and a large quantity of expectoration. A thoracotomy had been effected but drainage was still insufficient. In December 1928 I revised the thoracotomy with improvement; then thoracoplasty and finally injection of iodoform and vaseline 50 per cent were the procedures employed. Prompt and apparently complete recovery followed.

## RECAPITULATION AND CONCLUSION

In an elementary manner this essay is intended to demonstrate how surgery can aid in checking the progress of pulmonary phthisis.

1. It states that there is an inherent inclination toward healing in organs which exhibit the effects of tuberculous infection.

2. That rest in the mechanical and physiological meaning of the word, is the end to be attained, and in order that rest may be complete perfect drainage is requisite whenever there is something to drain. That when there is no cavity to be drained, as in early tuberculous pneumonitis, rest may prevent extension of the disease and will aid in hastening fibrosis.

3. Most of the ordinary operative methods and their possible results are described in a few words.

4. Statistics and their value are superficially discussed.

The duty of the surgeon will now be outlined according to my personal opinion and viewpoint and I hope that physicians, too, will see that operative therapy holds out hope in many cases when all else has failed. It is my earnest wish that this

essay may especially stimulate the consciousness of those who are intrusted with the care of the tuberculous so that too much time and vitality may not be wasted before the idea of operative treatment is seriously considered.

By this I do not mean that there should be a demand for "early operation" as in cancer. Malignant neoplasms show no tendency to disappear spontaneously[1] while I have emphasized the well-known healing trend of tuberculosis. The challenge which the surgeon feels on the presentation of mere roentgenological evidence of surgical curability and the great danger of precipitate action was brought home to me some years ago in a manner which I shall not forget.

During an informal conference of surgeon, roentgenologist and phthisiologist at Loomis Sanatorium, Dr. Amberson presented the *x*-ray picture of a patient and requested an opinion as to the proper therapy for this case. There were the characteristic appearances of advanced fibrocavernous right-sided disease with a left lung remarkably free from lesions. I remember that the upper half of the affected lung presented clearly marked evidence of cavities of large size and that there were opacities representing scattered areas of consolidation. As I recollect this film, there was little or no retraction of the right thorax. Without asking any questions I stated that this case appeared suitable for thoracoplastic compression when, to my amazement 8 or 9 subsequent films of the same chest were displayed revealing steady improvement; the final picture, four years after the first, being that of an almost normal thorax! And this result had been attained by purely medical and hygienic means, not even pneumothorax having been employed. The joke was on me, although no one would have actually operated in this, or in any case of tuberculosis, without knowing its course from the inception. In any destructive infection of the lung, tuberculous or otherwise, one should not operate in the face of steady improvement, nor hold off too long when there is progressive destruction.

[1] At any rate this phenomenon is so unusual that, practically, it may be disregarded.

In the ten illustrative cases which have been presented here not one could have gone on to restoration of health but all would almost surely have perished. A few months was the longest estimated term of life and some patients were in a state which could only be described as premoribund, if I may coin a word. There are three deaths in this list; a far better showing than my general mortality rate. I intend to publish elsewhere the results of all of my operations, without regard to any postoperative time limit.

When a tuberculous patient has become hopeless under medical treatment and when it is known that a certain number of similar cases have shown definite and lasting improvement, even cure, following operation, I maintain that nothing stands in the way of operative therapy except the fear of a high mortality rate; or as this is sometimes paraphrased, the *discredit of surgery*. But, surely it cannot be to the credit of surgery to refuse help in any case no matter how desperate. I cannot imagine a surgeon's refusal to operate for strangulated hernia, even if the patient seemed to be near his end and even though he were at the same time suffering from another apparently fatal disease such as phthisis or advanced nephritis. Yet I have seen a patient die of tense pneumothorax from the perforation of a pulmonary cavity into the pleura, when respite might have been afforded by paracentesis or minor thoracotomy.

Who shall say when death is inevitable? Most of us will call to mind some farewell visit to a dying patient who next day greeted us with a "good morning."

It seems but yesterday when a massive pulmonary embolism meant certain and almost instant death; but thanks to the originality—yes, even to the valor of grand old Trendelenburg, some of these who were apparently dead have been resuscitated.

The true physician never gives up while there is life; and the true surgeon must not withhold his help merely to improve his record.

OBSERVATIONS ON THE

# REACTION OF BRONCHIAL FISTULAE TO ACUTE INFECTIONS OF THE UPPER RESPIRATORY TRACT*

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A FREQUENT phenomenon in those patients who have bronchial fistulae is the occurrence of an acute inflammation of the bronchial mucous membrane in the presence of an acute infection of the upper respiratory tract. This fact was brought to the attention of Dr. J. J. Singer and myself for the first time in 1924, by observing a patient who had a fistula leading into one of the larger bronchi of a lower lobe of the lung following the operation of cautery pneumonectomy. The discharge from the fistula ordinarily was so slight as to consist only of enough mucus secreted during the day to make a small spot on the dressings. When, however, the patient developed an acute infection of the nasal sinuses the mucous membrane of the exposed bronchus was seen to become red and swollen and to discharge large quantities of secretion which at first was almost pure mucus but later became mucopurulent. This observation has been extended to include many other cases since that first one, probably in all about fifty. The local manifestations of acute infection in the bronchus usually do not appear until about twenty-four hours after the onset of the acute sinus disease. With the subsidence of the acute infection in the nasal sinuses the local reaction in the bronchus also subsides. The mucous membrane loses its swelling, assumes a more nearly normal color, and the amount of secretion of mucus greatly diminishes. Bacteriological examinations of the secretion from the nasal

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sinuses and from the exposed bronchus almost always reveal the same organism. In many of the cases in which the examination was made the prevailing organism has been streptococcus.

The importance of these observations lies in the relationship which they indicate to exist between the upper and the lower respiratory tracts. It is a well-known fact that the symptoms of a bronchiectasis even when involving a lower lobe of the lung are usually aggravated by the presence of infection in the nasal sinuses. Conversely the clearing of an infection in the nasal sinuses in a patient with bronchiectasis will usually result in a diminution in the amount of secretion which is coughed up. Occasionally it happens that the removal of polypi from the nasal sinuses of a bronchiectatic patient results in so marked a reduction of the amount of sputum and other distressing symptoms that the patient is able to take up an occupation from which he would otherwise be debarred. The observation that in the presence of acute infections of the nasal sinuses there is also a corresponding involvement of the lower bronchial tree, which has been made by direct visualization of an exposed bronchus, so far as I know has not been recorded before. It is chiefly for this reason as well as to express my admiration for the magnificent career of Rudolph Matas that I desire to record these observations here.

The question of how the infection spreads from a nasal sinus to the lower portions of the bronchial tree is one which cannot be answered with entire satisfaction. Whether it spreads through the lymphatics or by direct extension by continguity is still a question which so far as I know cannot be settled at the present time.